Wastewater System Improvements

City of Hart

Oceana County, Michigan

BioPure Treatment Facility

SRF Project No. 5845-01

U.S. Department of Commerce, Economic Development Administration Award No. 06-79-06430

January 2023

2211159

Prein&Newhof

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DIVISION 0

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Advertisement

Owner:	City of Hart
Project Title:	Wastewater System Improvements - BioPure Treatment Facility
Project #:	2211159

SRF Project No.: 5845-01
EDA Award No. 06-79-06430

1. RECEIPT OF BIDS

   Sealed bids for the above project will be received by the City of Hart at Hart City Hall, 407 State Street, Hart, Michigan until:

   2:00 pm (local time) on May 16th, 2023

   at which time the bids will be publicly opened and read aloud.

2. PRE-BID MEETING

   A mandatory bidders information meeting will be held at the City of Hart Biopure Facility, 2687 N. 88th, on May 2nd, 2023 at 10:00 am (local time). This meeting will be an opportunity for Contractors to review the work area. Attendance at the bidders information meeting is mandatory for all General Contractors wishing to submit a bid on the project. Minutes of the bidders information meeting will be forwarded to all plan holders as an addendum.

3. SCOPE OF PROJECT

   The project consists of furnishing all material and constructing the following:

   - Construction of a Headworks Building including a screening system and grit removal system;
   - Dividing the existing biosolids basin into a biosolids basin and an aeration basin, including floating air laterals, diffusers, an outlet structure, and aeration blower piping modifications;
   - Dividing the existing polishing pond into a polishing pond and a biosolids basin;
   - Addition of mechanical aerating mixers to the biosolids basins;
   - Rehabilitation of the Polishing Pond Pump Station and force main;
   - Construction of a new Biosolids Pump Station and force main;
   - Improvements to the Rapid Infiltration Basins (RIBs);
   - Construction of one (1) secondary clarifier, two (2) return activated sludge pumps and associated piping and appurtenances;

Also included is all associated equipment, valves, piping, mechanical, electrical, controls, and site work.

4. EXAMINATION OF SPECIFICATIONS

Contract documents may be examined online at www.preinnewhof.com/plan-room or at the offices of:
City of Hart, Hart City Hall, 407 State Street, Hart, MI 49420
Prein&Newhof, 4910 Stariha Drive, Muskegon, MI 49441
And some local plan rooms.

5. DEPOSIT FOR DRAWINGS AND SPECIFICATIONS

Drawings and specifications are available online at www.preinnewhof.com/plan-room or at the Grand Rapids office of Prein&Newhof after 2:00 PM, April 17, 2023. Electronic drawings, specifications and bidding documents will be accessible/available only to those Bidders who are active members of the Prein&Newhof Plan Room. Bidder assumes sole risk for any project drawings and specifications, electronic or hard copy, obtained other than directly from Prein&Newhof. Hard copy drawings and specifications are available for the fee of $615.00 dollars. Prein&Newhof Plan Room members who want to purchase the hard copy of the drawings only, may do so for $387.00 dollars. A $20.00 dollar charge will be added to all mailed drawings and/or specifications. Fees are payable by cash or check only and are not refunded.

The Bidder is to complete the Bid Proposal documents that are included in the Project Specification book (online or hard copy), referring to the table of contents to identify the exact order of these documents. Regardless of how the bid documents are received, a hard copy (paper copy) of the Bid Proposal Documents must be submitted for bidding purposes. *No electronically submitted Proposals will be accepted.* The Bid Proposal Documents include: Bid Proposal Checklist, and Bid Proposal.

The Bidder must provide the signed Bid Proposal Documents in either type written or hand written (in ink) form and clearly and completely set forth all required lump sum amounts, unit prices or other costs in a legible and understandable manner. Illegibility of any work or figure in the proposal may be sufficient cause for rejection of the proposal by the Owners. No electronically submitted Proposals will be accepted.

Any conclusions or information obtained or derived from Contract Documents will be at the user's sole risk. Prein&Newhof will maintain in its Grand Rapids office the master copy (hard copy) of the Contract Documents from which all electronic copies are based. In the case of any contract discrepancy, the Master Copy (hard copy) shall be considered the controlling document.

7. FUNDING

The work to be performed under this contract will be financed and paid for by funds received from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Clean Water State Revolving Fund (SRF). SRF monies will be received by the City of Hart. This project will also be partially funded with Federal funds from the United States Department of Commerce,

Economic Development Administration and therefore is subject to the Federal laws and regulations associated with that program. **Davis-Bacon/Prevailing Federal Wages apply to this project.**

Federal Labor Standards Provisions for the and associated documents that are incorporated in this contract are included in Division 0 and Appendix A. The SRF Project Number is 5845-01, the EDA Award Number is 06-79-06430.

The Contractor also will be required to comply with the debarment and American Iron and Steel contractual language included in Appendix A.

8. BID SURETY

For bid surety requirements, see Section 00 21 13 Instructions to Bidders.

9. RIGHT TO REJECT BIDS

The Owner reserves the right to reject any or all bids and to waive any irregularities in bidding. No bid may be withdrawn after the scheduled closing time for receiving bids for at least one hundred twenty (120) days thereafter.

10. PROJECT AWARD

Project will be awarder to the lowest responsive and responsible bidder as determined by the Owner.

11. COMMENCEMENT OF WORK

Construction activities are to begin as soon as possible following contract award and EDA approval. It is the intent of the Owner to consider award of the Contract, contingent upon receipt of funds, to the successful bidder at the May 23, 2023 City Council Meeting. Refer to Section 01 10 00 Summary of Work for additional limitations on construction operations.

12. COMPLETION DATE

Final Completion Date: December 31, 2025.

Robert Splane, Manager
City of Hart
Oceana County, Michigan

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Instructions To Bidders

Owner:	City of Hart
Project Title:	Wastewater System Improvements - BioPure Treatment Facility
Project #:	2211159

1. CONTRACT DOCUMENTS

   The contract documents consist of material outlined in Article 9 of the Agreement. Each Bidder shall carefully examine his copy of the contract documents for completeness. No claim will be allowed on the basis that the contract documents are not complete.

2. INTERPRETATION OF THE CONTRACT DOCUMENTS

   It is the intent of these contract documents to be clear, complete and consistent. If Bidder is of the opinion that any portion of the contract documents is ambiguous, inconsistent or contains errors or omissions Bidder shall, prior to submitting its bid, in writing request Engineer to clarify that portion of the contract documents as an addendum. This interpretation or correction will be made a part of the contract documents as an addendum. Any such addendum shall be mailed, faxed, e-mailed or delivered only to each person recorded as having received/downloaded a copy of the contract documents directly from Prein&Newhof or who was recorded of being in attendance at the mandatory pre-bid meeting.

   Only written addenda issued by the Engineer shall be binding. Oral interpretations, information or instructions by any office or employee of the Owner or Engineer are not authorized and therefore are not binding.

   Questions related to the project should be directed to Peter Brink, P.E., at 231-798-0101 or via email at pbrink@preinnewhof.com.

   Any conclusions or information obtained or derived from Contract Documents will be at the user's sole risk. Prein&Newhof will maintain the master copy (hard copy), from which all electronic copies are based in its Grand Rapids Office. In the case of any contract discrepancy, the Master Copy (hard copy) shall be considered the controlling document.

3. PRE-BID MEETING

   A mandatory bidders information meeting will be held at the City of Hart Biopure Facility, 2687 N. 88th, on May 2nd, 2023 at 10:00 am (local time). This meeting will be an opportunity for Contractors to review the work area. Attendance at the bidders information meeting is mandatory for all General Contractors wishing to submit a bid on the project. Minutes of the bidders information meeting will be forwarded to all plan holders as an addendum.

4. BIDDERS INVESTIGATION

The Bidder will be responsible for inspecting the site of the proposed work to determine for himself all conditions under which he will be obligated to work. It is also expected that he will investigate and make his own determination concerning the available facilities for receiving, transporting, handling and storing construction equipment and materials, and concerning other local conditions that may affect his work.

5. PROJECT FUNDING

The work to be performed under this contract will be financed and paid for by funds received from by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) State Revolving Fund (SRF). SRF monies will be received by the City of Hart. This project will also be partially funded with Federal funds from the United States Department of Commerce, Economic Development Administration and therefore is subject to the Federal laws and regulations associated with that program. **Davis-Bacon/Prevailing Federal Wages apply to this project.**

Federal Labor Standards Provisions and associated documents that are incorporated in this contract are included in Appendix A. The SRF Project Number is 5845-01.

The Contractor also will be required to comply with the debarment and American Iron and Steel contractual language included in Appendix A.

6. BID PROPOSAL PREPARATION

A. Name, Address and Legal Status of Bidder

The name and legal status of the Bidder, Corporation, Partnership or an Individual, shall be stated in the Proposal. A corporation Bidder shall name the state in which its Articles of Incorporation are held, and must give the title of the official having authority, under the by-laws, to sign contracts. A partnership Bidder shall give the full names and addresses of all partners. An L.L.C. Bidder shall provide the full names and addresses of all members.

Anyone signing a proposal as an agent of another must submit, with his proposal, legal evidence of his authority to act as an authorized agent of the party.

The place of residence of each Bidder, or the office address in the case of a firm or company, with county and state, must be given after a signature.

B. Experience and Qualifications

It is the intention of the Owner to award this contract to a Bidder that will perform and complete all work in compliance with the Contract Documents and in a workmanlike and professional manner. Bids are therefore only solicited from responsible Bidders known to be skilled, experienced and regularly engaged in work of similar character and magnitude to that covered by these contract documents.

After the opening of bids, when so requested by the Owner or Engineer, the Bidder will be required to provide documentation of the extent and nature of his experience in work of this kind and to furnish references as to his experience on projects of similar types and concerning contractor's ability to timely and within budget perform work of the type

involved in this project. The successful Bidder shall submit a statement of his experience and financial status, a list of all jobs he now has underway, with the volume and percent completed. If the successful Bidder is an LLC, bidder shall provide, if requested, personal guarantees of its members.

In addition to the above, when so requested, the Bidder shall meet with the Owner's representatives and give further information in relation to his proposed construction plan, methodology, and schedule of operations, in order to determine the Bidder's qualifications, ability to perform the Work, and timely complete the Work in accordance with the contract requirements.

C. Bid Surety

Each proposal must be accompanied by a bid deposit in the form of a bid bond payable to the Owner in the amount of not less than 5% of the total price for the Contract. The bond shall be issued by an insurance company licensed to do business in the State of Michigan.

Any Bidder who has submitted a proposal to the Owner may withdraw his bid at any time prior to the scheduled time for opening bids. No Bidder may withdraw his bid after the opening for a period of one hundred twenty (120) days thereafter.

D. Return of Bid Deposits

The bid deposits of all Bidders, except the three lowest Bidders, will be returned within seven days after the opening of the bids. The bid deposits of the three lowest Bidders will be returned (1) within 48 hours after the contract shall have been awarded to the successful Bidder, the signed agreement has been delivered, and the required bonds have been approved by the Owner, or (2) after rejection of all bids.

E. Proposal Form

The Bidder is to complete the Bid Proposal Documents that are included in the Project Specification book (online or hard copy), referring to the table of contents to identify the exact order of these documents. Regardless of how the bid documents are received, a hard copy (paper copy) of the Bid Proposal Documents must be submitted for bidding purposes. *No electronically-submitted Proposals will be accepted.* The Bid Proposal Documents include: Bid Proposal Checklist and Bid Proposal.

The Bidder must provide the signed Bid Proposal Documents in either type written or hand written (in ink) form and clearly and completely set forth all required lump sum amounts, unit prices or other costs in a legible and understandable manner. Illegibility of any work or figure in the proposal may be sufficient cause for rejection of the proposal by the Owners. *No electronically-submitted Proposals will be accepted.*

Any conclusions or information obtained or derived from Contract Documents will be at the user's sole risk. Prein&Newhof will maintain the master copy (hard copy), from which all electronic copies are based in its Grand Rapids Office. In the case of any contract discrepancy, the Master Copy (hard copy) shall be considered the controlling document.

Each proposal must be enclosed in a sealed envelope addressed to Hart City Hall, 407 State Street, Hart, MI 49420 and labeled **"Proposal for City of Hart, Oceana County,**

Michigan, BioPure Treatment Facility" No electronically submitted Proposals will be accepted.

F. Proposal Data

Proposals shall be carefully prepared in strict accordance with contract requirements and these instructions and shall include all pertinent information required by the proposal form. Failure of the bidder to comply in any respect shall be grounds for rejection of the bidder's proposal.

The proposal for work is on a unit price basis.

No partial bids will be considered.

7. TIME AND LIQUIDATED DAMAGES

Bidder's attention is directed to the completion date(s) as indicated in Section 00 11 13 Advertisement and to the liquidated damage and expense clauses in the Agreement.

8. BONDS AND INSURANCE

See General Conditions, Article 6; Supplementary Conditions Article 6 and Section 00 73 16 Insurance Specifications.

9. AWARD AND EXECUTION OF THE CONTRACT

The contract shall be deemed as having been awarded when formal Notice of Award shall have been duly provided by the Owner upon the Bidder.

The Bidder to whom the contract shall have been awarded will be required to execute an Agreement in the form included in the Contract Documents and to furnish sureties, insurance policies and certificates all as required within fifteen (15) days after the award. In case of his refusal or failure to do so, he will be considered to have abandoned all his rights and interest in the award, and his bid deposit may be declared forfeited to the Owner and the work may be awarded to another Bidder.

10. STAKING, CONTROLS, MONUMENTS

Refer to Section 01 10 00 Summary of Work, Section 1.08 Staking, Controls, Monuments.

11. COORDINATION

Refer to Section 01 10 00 Summary of Work, Section 1.05 Work Sequence and Coordination.

12. PERMITS

Bidder's attention is directed to the required permits as indicated in Section 01 10 00 Summary of Work, Section 1.07 Permits.

13. UTILITIES

Refer to Section 01 10 00 Summary of Work, Section 1.12 Protection of Existing Utilities.

14. MAJOR EQUIPMENT ITEMS

The contract documents have been prepared on the basis of using equipment manufactured by firms listed first in the proposal. The pricing information on alternate manufacturer's equipment must take into consideration all structural, mechanical, and electrical work changes from that shown on the Drawings necessary for installation of the alternate equipment.

Only equipment of those manufacturers who have furnished like equipment and specialties for at least three similar facilities that have been in regular operation not less than two years will be considered. Evidence of experience and operational data may be required from the manufacturer to determine the suitability and efficiency of the equipment offered.

The following provisions apply in regard to furnishing and installing the major items of equipment.

A. The total lump sum bid includes furnishing and installing all items of major equipment of the "Base Bid" manufacturer listed.

B. The Owner may select items of any manufacturer listed in the tabulation and the Contractor shall furnish and install such items as selected. The contract price shall be adjusted by the difference between the sum of the installed prices for the item of manufacturer first listed and the installed price of the alternate as selected by the Owner.

C. The installed price stated in the proposal must include the preparation and submission to the Engineer of detailed drawings showing all modifications of the Contract Drawings necessary to accommodate such equipment.

D. Installed price stated in the proposal for various items of equipment shall include a complete operating installation including the furnishing and installing of any and all changes or additions in structures, piping, building, mechanical, electrical work, accessories and controls necessary to accommodate the equipment.

E. In any of the major items of equipment differ in specification from the equipment specifications of the contract documents a detailed description of the specific difference in the specifications between the manufacturer's bid item and the specifications included in the contract documents shall accompany the proposal.

F. Alternate manufacturers of process equipment shall furnish the Engineer within 24 hours after the bid a complete description accompanied by drawings and sketches of all equipment and controls which he intends to furnish. This information will be evaluated by the Engineer and used as a basis for equipment selection.

Refer to Section 01 60 00 Materials and Equipment for additional requirements.

15. FEDERAL PARTICIPATION DISCLOSURE

This project will be partially funded with Federal funds from the United States Department of Commerce, Economic Development Administration and therefore is subject to the Federal laws and regulations associated with that program.

16. EDA REQUIREMENTS

There are several EDA requirements as part of this project. These requirements are referenced in the Contracting Provisions for Construction Projects and other EDA required forms.

END OF SECTION

OMB Number: 0610-0096
Expiration Date: 01/31/2025

U. S. DEPARTMENT OF COMMERCE
ECONOMIC DEVELOPMENT ADMINISTRATION

EDA CONTRACTING PROVISIONS
FOR CONSTRUCTION PROJECTS

These EDA Contracting Provisions for Construction Projects (EDA Contracting Provisions) are intended for use by recipients receiving federal assistance from the U. S. Department of Commerce - Economic Development Administration (EDA). They contain provisions specific to EDA and other federal provisions not normally found in non-federal contract documents. The requirements contained herein must be incorporated into all construction contracts and subcontracts funded wholly or in part with federal assistance from EDA.

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1. DEFINITIONS

Agreement – The written instrument that is evidence of the agreement between the Owner and the Contractor overseeing the Work.

Architect/Engineer - The person or other entity engaged by the Recipient to perform architectural, engineering, design, and other services related to the work as provided for in the contract.

Contract – The entire and integrated written agreement between the Owner and the Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

Contract Documents – Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents.

Contractor – The individual or entity with whom the Owner has entered into the Agreement.

Drawings or Plans – That part of the Contract Documents prepared or approved by the Architect/Engineer that graphically shows the scope, extent, and character of the Work to be performed by the Contractor.

EDA - The United States of America acting through the Economic Development Administration of the U.S. Department of Commerce or any other person designated to act on its behalf. EDA has agreed to provide financial assistance to the Owner, which includes assistance in financing the Work to be performed under this Contract. Notwithstanding EDA's role, nothing in this Contract shall be construed to create any contractual relationship between the Contractor and EDA.

Owner – The individual or entity with whom the Contractor has entered into the Agreement and for whom the Work is to be performed.

Project – The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

Recipient – A non-Federal entity receiving a Federal financial assistance award directly from EDA to carry out an activity under an EDA program, including any EDA-approved successor to the entity.

Specifications – That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

Subcontractor – An individual or entity having direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

Work – The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

2. APPLICABILITY

The Project to which the construction work covered by this Contract pertains is being assisted by the United States of America through federal assistance provided by the U.S. Department of Commerce - Economic Development Administration (EDA). Neither EDA, nor any of its departments, entities, or employees is a party to this Contract. The following EDA Contracting Provisions are included in this Contract and all subcontracts or related instruments pursuant to the provisions applicable to such federal assistance from EDA.

3. FEDERALLY REQUIRED CONTRACT PROVISIONS

(a) All contracts in excess of the simplified acquisition threshold - currently fixed at $150,000 (*see* 41 U.S.C. §§ 134 and 1908) must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as may be appropriate.

(b) All contracts in excess of $10,000 must address termination for cause and for convenience by the Recipient including the manner by which it will be effected and the basis for settlement.

(c) All construction contracts awarded in excess of $10,000 by recipients of federal assistance and their contractors or subcontractors shall contain a provision requiring compliance with Executive Order 11246 of September 24, 1965, *Equal Employment Opportunity*, as amended by Executive Order 11375 of October 13, 1967, and Department of Labor implementing regulations at 41 C.F.R. part 60.

(d) All prime construction contracts in excess of $2,000 awarded by Recipients must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. §§ 3141-3148) as supplemented by Department of Labor regulations at 29 C.F.R. part 5. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (18 U.S.C. § 874 and 40 U.S.C. § 3145) as supplemented by Department of Labor regulations at 29 C.F.R. part 3.

(e) All contracts awarded by the Recipient in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. §§ 3702 and 3704 (the Contract Work Hours and Safety Standards Act) as supplemented by Department of Labor regulations at 29 C.F.R. part 5.

(f) All contracts must include EDA requirements and regulations that involve a requirement on the contractor or sub-contractor to report information to EDA, the Recipient or any other federal agency.

(g) All contracts must include EDA requirements and regulations pertaining to patent rights with respect to any discovery or invention which arises or is developed in the course of or under such contract.

(h) All contracts must include EDA requirements and regulations pertaining to copyrights and rights in data.

(i) All contracts and subgrants in excess of $150,000 must contain a provision that requires compliance with all applicable standards, orders, or requirements issued under the Clean Air Act (42 U.S.C. § 7401 *et seq.*) and the Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. § 1251 *et seq.*), and Executive Order 11738, *Providing for Administration of the Clean Air Act and the Federal Water Pollution Control Act With Respect to Federal Contracts, Grants, or Loans*.

(j) Contracts must contain mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C.§ 6201).

(k) Contracts must contain a provision ensuring that contracts are not to be made to parties on the government wide Excluded Parties List System in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 C.F.R. part 180.

(l) Contracts must contain a provision ensure compliance with the Byrd Anti-Lobbying Amendment (31 U.S.C. § 1352) under which contractors that apply or bid for an award of $100,000 or more must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. § 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

(m) If the Recipient is a state agency or agency of a political subdivision of a state, any contract awarded must contain a provision ensuring compliance with section 6002 of the Solid Waste Disposal Act (42 U.S.C. § 6962), as amended by the Resource Conservation and Recovery Act related to the procurement of recovered materials.

4. REQUIRED PROVISIONS DEEMED INSERTED

Each and every provision of law and clause required by law to be inserted in this contract shall be deemed to be inserted herein and the contract shall be read and enforced as though it were included herein, and if through mistake or otherwise any such provision is not inserted, or is not correctly inserted, then upon the application of either party the contract shall forthwith be physically amended to make such insertion of correction.

5. INSPECTION BY EDA REPRESENTATIVES

The authorized representatives and agents of EDA shall be permitted to inspect all work, materials, payrolls, personnel records, invoices of materials, and other relevant data and records.

6. EXAMINATION AND RETENTION OF CONTRACTOR'S RECORDS

(a) The Owner, EDA, or the Comptroller General of the United States, or any of their duly authorized representatives shall, generally until three years after final payment under this contract, have access to and the right to examine any of the Contractor's directly pertinent books, documents, papers, or other records involving transactions related to this contract for the purpose of making audit, examination, excerpts, and transcriptions.

(b) The Contractor agrees to include in first-tier subcontracts under this contract a clause substantially the same as paragraph (a) above. "Subcontract," as used in this clause, excludes purchase orders that do not exceed $10,000.

(c) The periods of access and examination in paragraphs (a) and (b) above for records relating to (1) appeals under the disputes clause of this contract, (2) litigation or settlement of claims arising from the performance of this contract, or (3) costs and expenses of this contract to which the Owner, EDA, or Comptroller General or any of their duly authorized representatives has taken exception shall continue until disposition of such appeals, litigation, claims, or exceptions.

7. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

Immediately after execution and delivery of the contract, and before the first partial payment is made, the Contractor shall deliver to the Owner an estimated construction progress schedule in a form satisfactory to the Owner, showing the proposed dates of commencement and completion of each of the various subdivisions of work required under the Contract Documents and the anticipated amount of each monthly payment that will become due to the Contractor in accordance with the progress schedule. The Contractor also shall furnish the Owner (a) a detailed estimate giving a complete breakdown of the contract price and (b) periodic itemized estimates of work done for the purpose of making partial payments thereon. The costs employed in making up any of these schedules will be used only to determine the basis of partial payments and will not be considered as fixing a basis for additions to or deductions from the contract price.

8. CONTRACTOR'S TITLE TO MATERIAL

No materials, supplies, or equipment for the work shall be purchased by the Contractor or by any subcontractor that is subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants and guarantees that he/she has good title to all work, materials, and equipment used by him/her in the Work, free and clear of all liens, claims, or encumbrances.

9. INSPECTION AND TESTING OF MATERIALS

All materials and equipment used in the completion of the Work shall be subject to adequate inspection and testing in accordance with accepted standards. The laboratory or inspection agency shall be selected by the Owner. Materials of construction, particularly those upon which the strength and durability of any structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for intended uses.

10. "OR EQUAL" CLAUSE

Whenever a material, article, or piece of equipment is identified in the Contract Documents by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended merely to establish a standard. Any material, article, or equipment of other manufacturers and vendors that will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or equipment so proposed is, in the opinion of the Architect/Engineer, of equal substance and function. However, such substitution material, article, or equipment shall not be purchased or installed by the Contractor without the Architect/Engineer's written approval.

11. PATENT FEES AND ROYALTIES

(a) Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device that is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Architect/Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by the Owner in the Contract Documents.

(b) To the fullest extent permitted by Laws and Regulations, the Contractor shall indemnify and hold harmless the Owner and the Architect/Engineer, and the officers, directors, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

12. CLAIMS FOR EXTRA COSTS

No claims for extra work or cost shall be allowed unless the same was done in pursuance of a written order from the Architect/Engineer approved by the Owner.

13. CONTRACTORS AND SUBCONTRACTORS INSURANCE

(a) The Contractor shall not commence work under this Contract until the Contractor has obtained all insurance reasonably required by the Owner, nor shall the Contractor allow any subcontractor to commence work on his/her subcontract until the insurance required of the subcontractor has been so obtained and approved.

(b) Types of insurance normally required are:

(1) Workers' Compensation
(2) Contractor's Public Liability and Property Damage
(3) Contractor's Vehicle Liability
(4) Subcontractors' Public Liability, Property Damage and Vehicle Liability
(5) Builder's Risk (Fire and Extended Coverage)

(c) **Scope of Insurance and Special Hazards:** The insurance obtained, which is described above, shall provide adequate protection for the Contractor and his/her subcontractors, respectively, against damage claims that may arise from operations under this contract, whether such operations be by the insured or by anyone directly or indirectly employed by him/her and also against any of the special hazards that may be encountered in the performance of this Contract.

(d) **Proof of Carriage of Insurance:** The Contractor shall furnish the Owner with certificates showing the type, amount, class of operations covered, effective dates, and dates of expiration of applicable insurance policies.

14. CONTRACT SECURITY BONDS

(a) If the amount of this Contract exceeds $150,000, the Contractor shall furnish a performance bond in an amount at least equal to one hundred percent (100%) of the Contract price as security for the faithful performance of this Contract and also a payment bond in an amount equal to one hundred percent (100%) of the Contract price or in a penal sum not less than that prescribed by State, Territorial, or local law, as security for the payment of all persons performing labor on the Work under this Contract and furnishing materials in connection with this Contract. The performance bond and the payment bond may be in one or in separate instruments in accordance with local law. Before final acceptance, each bond must be approved by EDA. If the amount of this Contract does not exceed $150,000, the Owner shall specify the amount of the payment and performance bonds.

(b) All bonds shall be in the form prescribed by the Contract Documents except as otherwise provided in applicable laws or regulations, and shall be executed by such sureties as are named in the current list of *Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies* as published in Treasury Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent must be accompanied by a certified copy of the agent's

authority to act. Surety companies executing the bonds must also be authorized to transact business in the state where the Work is located.

15. **LABOR STANDARDS - DAVIS-BACON AND RELATED ACTS**
(as required by section 602 of PWEDA)

(a) **Minimum Wages**

(1) All laborers and mechanics employed or working upon the site of the Work in the construction or development of the Project will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act at 29 C.F.R. part 3, the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at the time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor, which is attached hereto and made a part hereof, regardless of any contractual relationship that may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 C.F.R. § 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 C.F.R. § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates determined under 29 C.F.R. § 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(2) (i) Any class of laborers or mechanics to be employed under the Contract, but not listed in the wage determination, shall be classified in conformance with the wage determination. EDA shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(A) The work to be performed by the classification requested is not performed by a classification in the wage determination;

(B) The classification is utilized in the area by the construction industry; and

(C) The proposed wage rate, including any bona fide fringe benefits, bears a

reasonable relationship to the wage rates contained in the wage determination.

(ii) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and EDA or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by EDA or its designee to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210.

(iii) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and EDA or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), EDA or its designee shall refer the questions, including the views of all interested parties and the recommendation of EDA or its designee, to the Administrator for determination.

(iv) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(2)(ii) or (iii) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(3) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(4) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(b) **Withholding**

EDA or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this Contract or any other federal contract with the same prime Contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the Contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper employed or working on the site of the Work in the construction or development of the Project, all or part of the wages required by the Contract, EDA or its designee may, after written notice to the Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations

have ceased. EDA or its designee may, after written notice to the Contractor, disburse such amounts withheld for and on account of the Contractor or subcontractor to the respective employees to whom they are due. The Comptroller General shall make such disbursements in the case of direct Davis-Bacon Act contracts.

(c) **Payrolls and basic records**

(1) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the Work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the Work in the construction or development of the Project. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 C.F.R. § 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, the plan or program is financially responsible, and the plan or program has been communicated in writing to the laborers or mechanics affected, and provide records that show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(2) (i) For each week in which Contract work is performed, the Contractor shall submit a copy of all payrolls to the Owner for transmission to EDA or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 C.F.R. part 5.5(a)(3)(i). This information may be submitted in any form desired. Optional Form WH-347 is available for this purpose. It may be purchased from the Superintendent of Documents (Federal Stock Number 029-005-00014-1), U.S. Government Printing Office, Washington, D.C. 20402; or downloaded from the U.S. Department of Labor's website at https://www.dol.gov/whd/forms/wh347.pdf. The prime Contractor is responsible for the submission of copies of payrolls by all subcontractors

(ii) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the Contract and shall certify the following:

(A) That the payroll for the payroll period contains the information required to be maintained under 29 C.F.R. § 5.5(a)(3)(i) and that such information is correct and complete;

(B) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the Contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 C.F.R. part 3; and

(C) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the Contract.

(iii) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 15(c)(2)(ii) of this section.

(iv) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under section 1001 of Title 18 and section 3729 of Title 31 of the U.S. Code.

(3) The Contractor or subcontractor shall make the records required under paragraph 15(c)(1) of this section available for inspection, copying, or transcription by authorized representatives of EDA or its designee or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, EDA or its designee may, after written notice to the Contractor or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 C.F.R. § 5.12.

(d) **Apprentices and Trainees**.

(1) **Apprentices**. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Bureau of Apprenticeship and Training (Bureau), or with a State Apprenticeship Agency recognized by the Bureau, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Bureau of Apprenticeship and Training or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any

apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a Contractor is performing construction on a Project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Bureau of Apprenticeship and Training, or a State Apprenticeship Agency recognized by the Bureau, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) **Trainees**. Except as provided in 29 C.F.R. § 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program that has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman's hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(3) **Equal employment opportunity**. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity

requirements of Executive Order 11246, *Equal Employment Opportunity*, as amended, and 29 C.F.R. part 30.

(e) **Compliance with Copeland Anti-Kickback Act Requirements**. The Contractor shall comply with the Copeland Anti-Kickback Act (18 U.S.C. § 874 and 40 U.S.C. § 3145) as supplemented by Department of Labor regulations (29 C.F.R. part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States"). The Act provides that the Contractor and any subcontractors shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which they are otherwise entitled. The Owner shall report all suspected or reported violations to EDA.

(f) **Subcontracts**. The Contractor and any subcontractors will insert in any subcontracts the clauses contained in 29 C.F.R. §§ 5.5(a)(1) through (10) and such other clauses as EDA or its designee may require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 C.F.R. § 5.5.

(g) **Contract termination; debarment**. The breach of the contract clauses in 29 C.F.R. § 5.5 may be grounds for termination of the contract, and for debarment as a Contractor and a subcontractor as provided in 29 C.F.R. § 5.12.

(h) **Compliance with Davis-Bacon and Related Act Requirements**. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 C.F.R. parts 1, 3, and 5 are herein incorporated by reference in this contract.

(i) **Disputes concerning labor standards**. Disputes arising out of the labor standards provisions of this Contract shall not be subject to the general disputes clause of this Contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 C.F.R. parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and EDA or its designee, the U.S. Department of Labor, or the employees or their representatives.

(j) **Certification of Eligibility**.

(1)By entering into this Contract, the Contractor certifies that neither it nor any person or firm that has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 C.F.R. § 5.12(a)(1).

(2) No part of this Contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 C.F.R. § 5.12(a)(1).

(3) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. § 1001.

16. LABOR STANDARDS - CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(a) **Overtime requirements**. No Contractor or subcontractor contracting for any part of the Contract work, which may require or involve the employment of laborers or mechanics, shall require or permit any such laborer or mechanic in any workweek in which that person is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(b) **Violation; liability for unpaid wages, liquidated damages**. In the event of any violation of the clause set forth in paragraph (a) of this section, the Contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a) of this section.

(c) **Withholding for unpaid wages and liquidated damages**. EDA or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any monies payable on account of work performed by the Contractor or subcontractor under any such Contract or any other federal contract with the same prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b) of this section.

(d) **Subcontracts**. The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraphs (a) through (c) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a) through (c) of this section.

17. EQUAL EMPLOYMENT OPPORTUNITY

(a) The Recipient hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 C.F.R. chapter 60, which is paid for in whole or in part with funds obtained from EDA, the following equal opportunity clause:

During the performance of this contract, the Contractor agrees as follows:

(1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(3) The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

(4) The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers representatives of the Contractor's commitments hereunder, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(5) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965 and of the rules, regulations, and relevant orders of the Secretary of Labor.

(6) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by EDA and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(7) In the event of the Contractor's noncompliance with the nondiscrimination clauses of

this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts or federally-assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

(8) The Contractor will include the portion of the sentence immediately preceding paragraph 17(a)(1) and the provisions of paragraphs 17(a)(1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as EDA or the Secretary of Labor may direct as a means of enforcing such provisions, including sanctions for noncompliance. Provided, however, that in the event the Contractor becomes involved in or is threatened with litigation with a subcontractor or vendor as a result of such direction by EDA or the Secretary of Labor, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

(9) The Recipient further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally-assisted construction work. Provided, however, that if the Recipient so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality, or subdivision of such government that does not participate in work on or under the Contract.

(10)The Recipient agrees that it will assist and cooperate actively with EDA and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish EDA and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist EDA in the discharge of the EDA's primary responsibility for securing compliance.

(11) The Recipient further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a Contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by EDA or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the Recipient agrees that if it fails or refuses to comply with these undertakings, EDA may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this EDA financial assistance; refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case

to the Department of Justice for appropriate legal proceedings.

(b) Exemptions to Above Equal Opportunity Clause (41 C.F.R. chapter 60):

(1) Contracts and subcontracts not exceeding $10,000 (other than Government bills of lading, and other than contracts and subcontracts with depositories of Federal funds in any amount and with financial institutions which are issuing and paying agents for U.S. savings bonds and savings notes) are exempt. The amount of the Contract, rather than the amount of the federal financial assistance, shall govern in determining the applicability of this exemption.

(2) Except in the case of subcontractors for the performance of construction work at the site of construction, the clause shall not be required to be inserted in subcontracts below the second tier.

(3) Contracts and subcontracts not exceeding $10,000 for standard commercial supplies or raw materials are exempt.

18. **CONTRACTING WITH SMALL, MINORITY AND WOMEN'S BUSINESSES**

(a) If the Contractor intends to let any subcontracts for a portion of the work, the Contractor shall take affirmative steps to assure that small, minority and women's businesses are used when possible as sources of supplies, equipment, construction, and services.

(b) Affirmative steps shall consist of:

(1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;

(2) Ensuring that small and minority businesses and women's business enterprises are solicited whenever they are potential sources;

(3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses and women's business enterprises;

(4) Establishing delivery schedules, where the requirements of the contract permit, which encourage participation by small and minority businesses and women's business enterprises;

(5) Using the services and assistance of the U.S. Small Business Administration, the Minority Business Development Agency of the U.S. Department of Commerce, and State and local governmental small business agencies;

(6) Requiring each party to a subcontract to take the affirmative steps of this section; and

(7) The Contractor is encouraged to procure goods and services from labor surplus area firms.

19. **HEALTH, SAFETY, AND ACCIDENT PREVENTION**

(a) In performing this contract, the Contractor shall:

(1) Ensure that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to their health and/or safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation;

(2) Protect the lives, health, and safety of other persons;

(3) Prevent damage to property, materials, supplies, and equipment; and

(4) Avoid work interruptions.

(b) For these purposes, the Contractor shall:

(1) Comply with regulations and standards issued by the Secretary of Labor at 29 C.F.R. part 1926. Failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act (40 U.S.C. §§ 3701 – 3708); and

(2) Include the terms of this clause in every subcontract so that such terms will be binding on each subcontractor.

(c) The Contractor shall maintain an accurate record of exposure data on all accidents incident to work performed under this Contract resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment, and shall report this data in the manner prescribed by 29 C.F.R. part 1904.

(d) The Owner shall notify the Contractor of any noncompliance with these requirements and of the corrective action required. This notice, when delivered to the Contractor or the Contractor's representative at the site of the Work, shall be deemed sufficient notice of the noncompliance and corrective action required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to take corrective action promptly, the Owner may issue an order stopping all or part of the Work until satisfactory corrective action has been taken. The Contractor shall not base any claim or request for equitable adjustment for additional time or money on any stop order issued under these circumstances.

(e) The Contractor shall be responsible for its subcontractors' compliance with the provisions of this clause. The Contractor shall take such action with respect to any subcontract as EDA, or the Secretary of Labor shall direct as a means of enforcing such provisions.

20. CONFLICT OF INTEREST AND OTHER PROHIBITED INTERESTS

(a) No official of the Owner who is authorized in such capacity and on behalf of the Owner to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspection, construction or material supply contract or any subcontract in connection with the construction of the Project, shall become directly or indirectly interested personally in this Contract or in any part hereof.

(b) No officer, employee, architect, attorney, engineer, or inspector of or for the Owner who is authorized in such capacity and on behalf of the Owner to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the Project, shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the Project.

(c) The Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the Contract Documents has a corporate or financial affiliation with the supplier or manufacturer.

(d) The Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, may be involved. Such a conflict may arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in the Contractor. The Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors, or anything of monetary value from the Contractor or subcontractors.

(e) If the Owner finds after a notice and hearing that the Contractor, or any of the Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of the Owner or EDA in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, the Owner may, by written notice to the Contractor, terminate this Contract. The Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which the Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.

(f) In the event this Contract is terminated as provided in paragraph (e) of this section, the Owner may pursue the same remedies against the Contractor as it could pursue in the event of a breach of this Contract by the Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, the Owner may pursue exemplary damages in an amount (as determined by the Owner) which shall not be less than three nor more than ten times the costs the Contractor incurs in providing any such gratuities to any such officer or employee.

21. RESTRICTIONS ON LOBBYING

(a) This Contract, or subcontract is subject to 31 U.S.C. § 1352, regarding lobbying restrictions. The section is explained in the common rule, 15 C.F.R. part 28 (55 FR 6736-6748, February 26, 1990). Each bidder under this Contract or subcontract is generally prohibited from using federal funds for lobbying the Executive or Legislative Branches of the Federal Government in connection with this EDA Award.

(b) **Contract Clause Threshold**: This Contract Clause regarding lobbying must be included in each bid for a contract or subcontract exceeding $100,000 of federal funds at any tier under the EDA Award.

(c) **Certification and Disclosure**: Each bidder of a contract or subcontract exceeding $100,000 of federal funds at any tier under the federal Award must file Form CD-512, *Certification Regarding Lobbying – Lower Tier Covered Transactions*, and, if applicable, Standard Form-LLL, *Disclosure of Lobbying Activities*, regarding the use of any nonfederal funds for lobbying. Certifications shall be retained by the Contractor or subcontractor at the next higher tier. All disclosure forms, however, shall be forwarded from tier to tier until received by the Recipient of the EDA Award, who shall forward all disclosure forms to EDA.

(d) **Continuing Disclosure Requirement**: Each Contractor or subcontractor that is subject to the Certification and Disclosure provision of this Contract Clause is required to file a disclosure form at the end of each calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed by such person. Disclosure forms shall be forwarded from tier to tier until received by the Recipient of the EDA Award, who shall forward all disclosure forms to EDA.

(e) **Indian Tribes, Tribal Organizations, or Other Indian Organizations**: Indian tribes, tribal organizations, or any other Indian organizations, including Alaskan Native organizations, are excluded from the above lobbying restrictions and reporting requirements, but only with respect to expenditures that are by such tribes or organizations for lobbying activities permitted by other federal law. An Indian tribe or organization that is seeking an exclusion from Certification and Disclosure requirements must provide EDA with the citation of the provision or provisions of federal law upon which it relies to conduct lobbying activities that would otherwise be subject to the prohibitions in and to the Certification and Disclosure requirements of 31 U.S.C. § 1352, preferably through an attorney's opinion. Note, also, that a non-Indian subrecipient, contractor, or subcontractor under an award to an Indian tribe, for example, is subject to the restrictions and reporting requirements.

22. HISTORICAL AND ARCHAEOLOGICAL DATA PRESERVATION

The Contractor agrees to facilitate the preservation and enhancement of structures and objects of historical, architectural or archaeological significance and when such items are found and/or unearthed during the course of project construction. Any excavation by the Contractor that uncovers an historical or archaeological artifact shall be immediately reported to the Owner and a representative of EDA. Construction shall be temporarily halted pending the notification process and further directions issued by EDA after consultation with the State Historic

Preservation Officer (SHPO) for recovery of the items. *See* the National Historic Preservation Act of 1966 (54 U.S.C. § 300101 *et seq.*, formerly at 16 U.S.C. § 470 *et seq.*) and Executive Order No. 11593 of May 31, 1971.

23. **CLEAN AIR AND WATER**

Applicable to Contracts in Excess of $150,000

(a) **Definition**. "Facility" means any building, plant, installation, structure, mine, vessel, or other floating craft, location, or site of operations, owned, leased, or supervised by the Contractor or any subcontractor, used in the performance of the Contract or any subcontract. When a location or site of operations includes more than one building, plant, installation, or structure, the entire location or site shall be deemed a facility except when the Administrator, or a designee, of the United States Environmental Protection Agency (EPA) determines that independent facilities are collocated in one geographical area.

(b) In compliance with regulations issued by the EPA, 2 C.F.R. part 1532, pursuant to the Clean Air Act, as amended (42 U.S.C. § 7401 *et seq.*); the Federal Water Pollution Control Act, as amended (33 U.S.C. § 1251 *et seq.*); and Executive Order 11738, the Contractor agrees to:

(1) Not utilize any facility in the performance of this contract or any subcontract which is listed on the Excluded Parties List System, part of the System for Award Management (SAM), pursuant to 2 C.F.R. part 1532 for the duration of time that the facility remains on the list;

(2) Promptly notify the Owner if a facility the Contractor intends to use in the performance of this contract is on the Excluded Parties List System or the Contractor knows that it has been recommended to be placed on the List;

(3) Comply with all requirements of the Clean Air Act and the Federal Water Pollution Control Act, including the requirements of section 114 of the Clean Air Act and section 308 of the Federal Water Pollution Control Act, and all applicable clean air and clean water standards; and

(4) Include or cause to be included the provisions of this clause in every subcontract and take such action as EDA may direct as a means of enforcing such provisions.

24. **USE OF LEAD-BASED PAINTS ON RESIDENTIAL STRUCTURES**

(a) If the work under this Contract involves construction or rehabilitation of residential structures over $5,000, the Contractor shall comply with the Lead-based Paint Poisoning Prevention Act (42 U.S.C. § 4831). The Contractor shall assure that paint or other surface coatings used in a residential property does not contain lead equal to or in excess of 1.0 milligram per square centimeter or 0.5 percent by weight or 5,000 parts per million (ppm) by weight. For purposes of this section, "residential property" means a dwelling unit, common areas, building exterior surfaces, and any surrounding land, including outbuildings, fences and play equipment affixed to the land, belonging to an owner and available for use by residents, but not

including land used for agricultural, commercial, industrial or other non-residential purposes, and not including paint on the pavement of parking lots, garages, or roadways.

(b) As a condition to receiving assistance under PWEDA, recipients shall assure that the restriction against the use of lead-based paint is included in all contracts and subcontracts involving the use of federal funds.

25. ENERGY EFFICIENCY

The Contractor shall comply with all standards and policies relating to energy efficiency which are contained in the energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. § 6201) for the State in which the Work under the Contract is performed.

26. ENVIRONMENTAL REQUIREMENTS

When constructing a Project involving trenching and/or other related earth excavations, the Contractor shall comply with the following environmental constraints:

(1) **Wetlands**. When disposing of excess, spoil, or other construction materials on public or private property, the Contractor shall not fill in or otherwise convert wetlands.

(2) **Floodplains**. When disposing of excess, spoil, or other construction materials on public or private property, the Contractor shall not fill in or otherwise convert 100 year floodplain areas delineated on the latest Federal Emergency Management Agency (FEMA) Floodplain Maps, or other appropriate maps, i.e., alluvial soils on Natural Resource Conservation Service (NRCS) Soil Survey Maps.

(3) **Endangered Species**. The Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of the Contractor, the Contractor will immediately report this evidence to the Owner and a representative of EDA. Construction shall be temporarily halted pending the notification process and further directions issued by EDA after consultation with the U.S. Fish and Wildlife Service.

27. DEBARMENT, SUSPENSION, INELIGIBILITY, AND VOLUNTARY EXCLUSIONS

As required by Executive Orders 12549 and 12689, *Debarment and Suspension*, 2 C.F.R. Part 180 and implemented by the Department of Commerce at 2 C.F.R. part 1326, for prospective participants in lower tier covered transactions (except subcontracts for goods or services under the $25,000 small purchase threshold unless the subrecipient will have a critical influence on or substantive control over the award), the Contractor agrees that:

(1) By entering into this Contract, the Contractor and subcontractors certify, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared

ineligible, or voluntarily excluded from participation in this Contract by any federal department or agency.

(2) Where the Contractor or subcontractors are unable to certify to any of the statements in this certification, the Contractor or subcontractors shall attach an explanation to this bid.

See also 2 C.F.R. part 180 and 2 C.F.R. § 200.342.

28. **EDA PROJECT SIGN**

The Contractor shall supply, erect, and maintain in good condition a Project sign according to the specifications provided by EDA. To the extent practical, the sign should be a free standing sign. Project signs shall not be located on public highway rights-of-way. Location and height of signs will be coordinated with the local agency responsible for highway or street safety in the Project area, if any possibility exists for obstructing vehicular traffic line of sight. Whenever the EDA site sign specifications conflict with State law or local ordinances, the EDA Regional Director will permit such conflicting specifications to be modified so as to comply with State law or local ordinance.

29. **BUY AMERICA**

To the greatest extent practicable, contractors are encouraged to purchase American-made equipment and products with funding provided under EDA financial assistance awards.

NOTE: To find the Goals for minority participation (%), click "What to use?" and search for the project's County.

Back

NOTICE OF REQUIREMENTS FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246 AND 41 CFR PART 60-4)

The following Notice shall be included in, and shall be a part of all solicitations for offers and bids on all Federal and federally assisted construction contracts or subcontracts in excess of $10,000.

The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for minority participation for each trade	Goals for female participation for each trade
What % to use?	9.7 %	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and non federally involved construction.
The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.
As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is:

State of Michigan

County of Oceana

City of Hart

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Back

FORM **CD-512**
(REV 12-04)

U.S. DEPARTMENT OF COMMERCE

CERTIFICATION REGARDING LOBBYING
LOWER TIER COVERED TRANSACTIONS

Applicants should review the instructions for certification included in the regulations before completing this form. Signature on this form provides for compliance with certification requirements under 15 CFR Part 28, "New Restrictions on Lobbying."

LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 15 CFR Part 28, for persons entering into a grant, cooperative agreement or contract over $100,000 or a loan or loan guarantee over $150,000 as defined at 15 CFR Part 28, Sections 28.105 and 28.110, the applicant certifies that to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

Statement for Loan Guarantees and Loan Insurance

The undersigned states, to the best of his or her knowledge and belief, that:

In any funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this commitment providing for the United States to insure or guarantee a loan, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure Form to Report Lobbying,'' in accordance with its instructions.

Submission of this statement is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required statement shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure occurring on or before October 23, 1996, and of not less than $11,000 and not more than $110,000 for each such failure occurring after October 23, 1996.

As the duly authorized representative of the applicant, I hereby certify that the applicant will comply with the above applicable certification.

NAME OF APPLICANT	AWARD NUMBER AND/OR PROJECT NAME

PRINTED NAME AND TITLE OF AUTHORIZED REPRESENTATIVE

What % to use?

SIGNATURE	DATE
	NOTE: To find the Goals for minority particip

[Intentionally left blank]

OMB Number: 0610-0096
Expiration Date: 01/31/2025

EDA PROJECT SIGN

The Contractor shall supply, erect, and maintain in good condition a project sign according to the specifications set forth below:

EDA SITE SIGN SPECIFICATIONS

Size: 4' x 8' x ¾"

Materials: Exterior grade/MDO plywood (APA rating A-B)

Supports: 4" x 4" x 12' posts with 2" x 4" cross branching

Erection: Posts shall be set a minimum of three feet deep in concrete footings that are at least 12" in diameter.

Paint: Outdoor enamel

Colors: Jet Black, Blue (PMS300), and Gold (PMS7406). Specifically, on white background the following will be placed:

The U. S. Department of Commerce seal in blue, black, and gold;

"EDA" in blue;

"U. S. DEPARTMENT OF COMMERCE ECONOMIC DEVELOPMENT

ADMINISTRATION" in black;

"In partnership with" in blue;

(Actual name of the) "EDA Grant Recipient" in black;

City of Hart

Lettering: Specific fonts are named below; positioning will be as shown on the attached illustration.

"U. S. DEPARTMENT OF COMMERCE ECONOMIC DEVELOPMENT ADMINISTRATION" use Bank Gothic Medium - BANK GOTHIC MED

"In partnership with" use Univers™ 55 Oblique - *Univers 55*

(Name of) "EDA Grant Recipient" use Univers™ Extra Black 85 **Univers 85**

Project signs will not be erected on public highway rights-of-way. If any possibility exists for obstruction to traffic line of sight, the location and height of the sign will be coordinated with the agency responsible for highway or street safety in the area.

The EDA Regional Director may permit modifications to these specifications if they conflict with state law or local ordinances.

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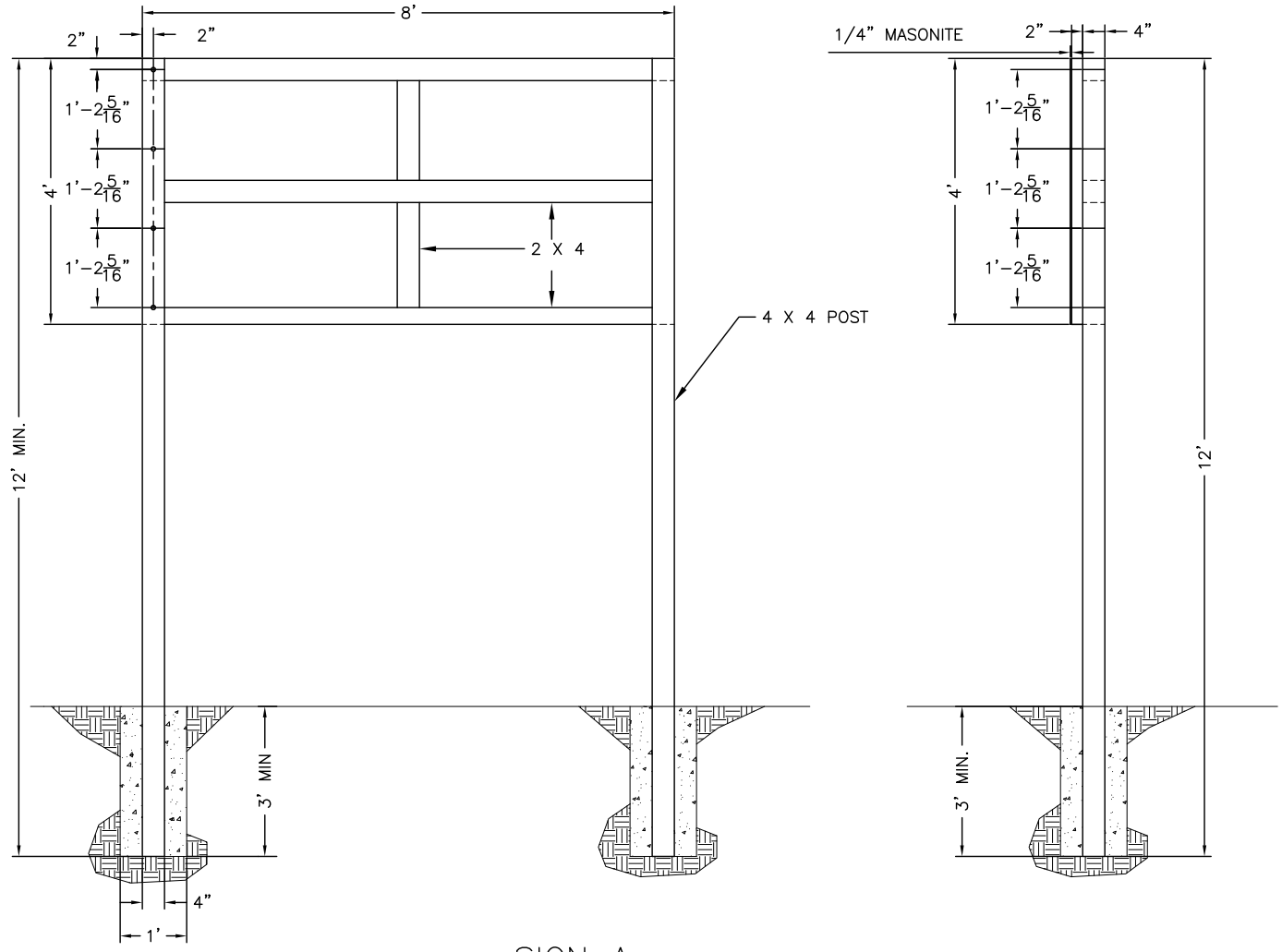
OMB Number: 0610-0096
Expiration Date: 01/31/2025

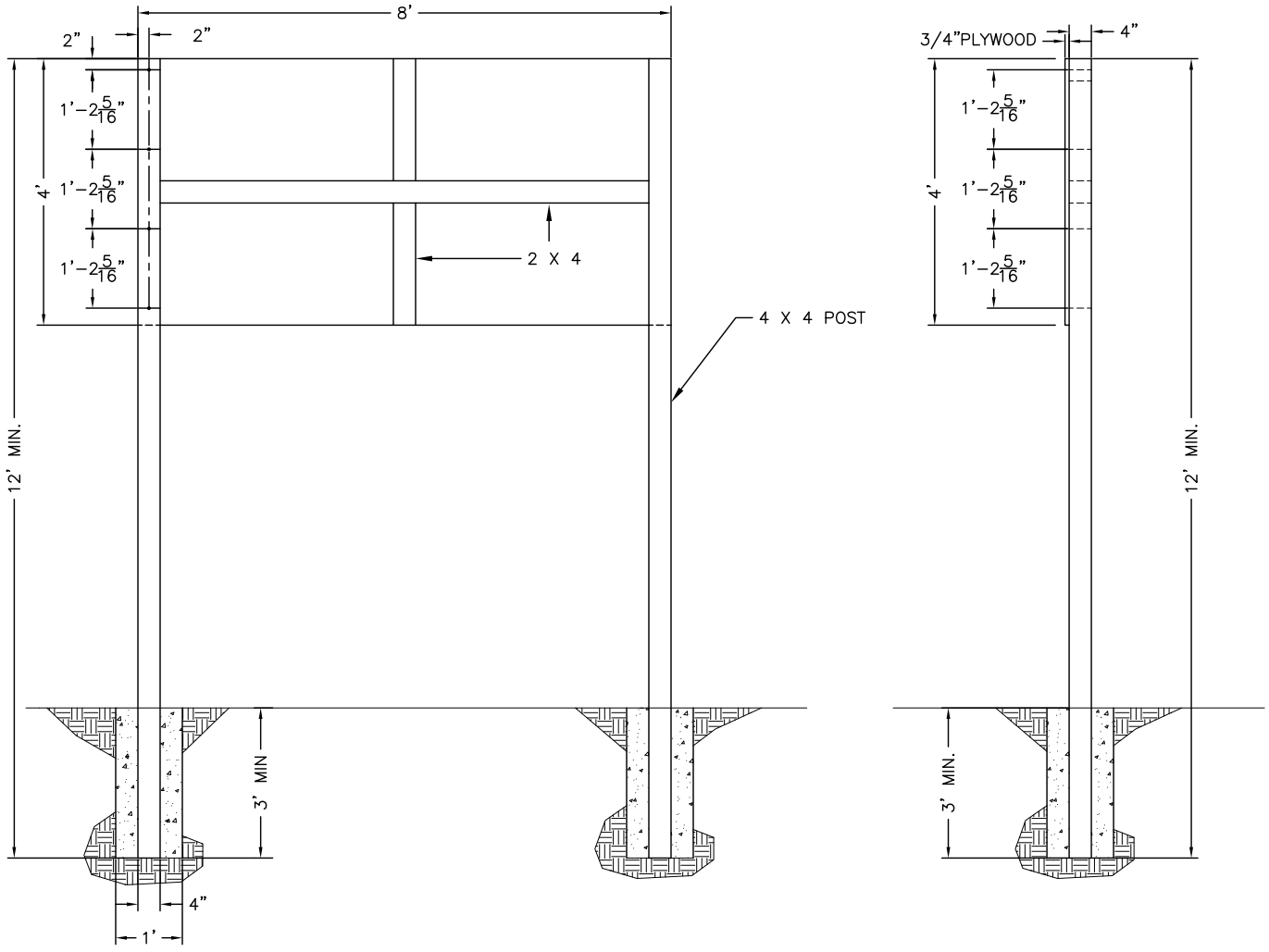


SIGN A
MASONITE SIGN

SCALE: 3/8" = 1'

PROJECT - SIGN A
ECONOMIC DEVELOPMENT ADMINISTRATION

OMB Number: 0610-0096
Expiration Date: 01/31/2025



SIGN B
PLYWOOD SIGN
SCALE: 3/8" = 1'

PROJECT - SIGN B
ECONOMIC DEVELOPMENT ADMINISTRATION

U.S. Department of Commerce Economic Development Administration

In partnership with

City of Hart

2.25”

13.5”

1.75”

1.75”

Black
Blue= PMS300
Gold= PMS7406

EDA

10”

2.0”

1.5”

4.0”

3.0”

3.0”

3.75”

15.0”

U.S. Department of Commerce Economic Development Administration

48”

In partnership with

City of Hart

96"

SECTION 00 42 00
BID PROPOSAL

Bid Proposal

Owner:	City of Hart			
Owner Address:	407 State St. Hart, MI 49420			
Project Title:	Wastewater System Improvements - BioPure Treatment Facility			
Bid Date & Time:	May 16, 2023 at 2:00 pm	Project #:	2211159	SRF Project No.: 5845-01 EDA Award No. 06-79-06430

The undersigned, being familiar with the site, drawings, specifications, and related documents, proposes to furnish all required labor, materials, tools and equipment to construct the project in accordance with the lump sum on the following sheets.

Date Prepared: _____

Receipt of Addenda

Receipt of Addenda _____ through _____ is hereby acknowledged.

Summary of Bids

Total Lump
Sum Bid $ _____

The Owner reserves the right to accept or reject any or all bids and to waive any irregularities in the bidding. No partial bids will be accepted.

Contractor's Signature

Contractor’s Name		Telephone Number
Business Address	City	Zip Code
Signature	Title	Date

Seal (if bidder is a corporation)

[Intentionally left blank]

Bid Proposal

Owner:	City of Hart			
Owner Address:	407 State St. Hart, MI 49420			
Project Title:	Wastewater System Improvements - BioPure Treatment Facility			
Bid Date & Time:	May 16, 2023 at 2:00 pm	Project #:	2211159	SRF Project No.: 5845-01 EDA Award No. 06-79-06430

1. This bid is submitted on the basis of using the following subcontractors:

Site Work _____

Concrete _____

Masonry _____

Painting _____

Mechanical _____

Electrical _____

Integration _____

No change from the subcontractors listed above will be allowed after the Proposal is submitted except by mutual consent of the Contractor and Owner in writing.

[Intentionally left blank]

Bid Proposal

Owner:	City of Hart			
Owner Address:	407 State St. Hart, MI 49420			
Project Title:	Wastewater System Improvements - BioPure Treatment Facility			
Bid Date & Time:	May 16, 2023 at 2:00 pm	Project #:	2211159	SRF Project No.: 5845-01 EDA Award No. 06-79-06430

SUPPLEMENTAL INFORMATION

For funding purposes, all costs associated with the following items must be broken out independently of the total bid. The information provided below is for information purposes only, and will not be used to determine award of the Project:

Provide total cost for the following construction activities:

1. Clarifier No. 3 and Associated Improvements – Clarifier, clarifier building addition including all contents, associated effluent piping, RAS4 and RAS5 and associated piping from Clarifier No. 3 to the Blower Room, and electrical controls and ventilation improvements – including electrical and ventilation work in the existing clarifier room.

   Total Cost Item No. 1: _____

2. Rapid Infiltration Basin (RIB) Improvements – Sampling enclosure and concrete pad, automatic refrigerated sampler and associated piping and accessories, magnetic flow meter and associated piping and accessories, modifications to the existing meter manhole, and electrical and controls work associated with the proposed sampler and flowmeter.

   Total Cost Item No. 2: _____

[Intentionally left blank]

Bid Proposal

Owner:	City of Hart			
Owner Address:	407 State St. Hart, MI 49420			
Project Title:	Wastewater System Improvements - BioPure Treatment Facility			
Bid Date & Time:	May 16, 2023 at 2:00 pm	Project #:	2211159	SRF Project No.: 5845-01 EDA Award No. 06-79-06430

MAJOR EQUIPMENT

The various major items are listed below with provisions for alternative manufacturers. The lump sum bid shall include equipment listed below as "Base Bid." Alternate will be considered if offered under "Alternate" with an increase "Add" or reduction "Deduct" below.

All cost associated with utilizing equipment provided by other manufacturers shall be included in the add or deduct including all building, electrical, mechanical or any other changes necessary to install the equipment.

The Owner may elect to choose any of the alternates, and the contract amount shall be adjusted accordingly.

	BASE BID COST	ALTERNATE Add	ALTERNATE Deduct
1. Epoxy Coatings (Section 09 96 56 Epoxy Coatings)			
Manufacturer			
Raven	$_____		
_____		$_____	$_____
2. Submersible Pumps (Section 33 32 11 Submersible Lift Stations)			
Manufacturer			
Flygt	$_____		
_____		$_____	$_____

[Intentionally left blank]

Bid Proposal

Owner:	City of Hart			
Owner Address:	407 State St. Hart, MI 49420			
Project Title:	Wastewater System Improvements - BioPure Treatment Facility			
Bid Date & Time:	May 16, 2023 at 2:00 pm	Project #:	2211159	SRF Project No.: 5845-01 EDA Award No. 06-79-06430

MAJOR EQUIPMENT (continued)

3. Eccentric Plug Valves (Section 40 05 51 Process Valves)

   Manufacturer

   DeZurik $_____

   _____ $_____ $_____

4. Swing Check Valves (Section 40 05 51 Process Valves)

   Manufacturer

   Kennedy or APCO $_____

   _____ $_____ $_____

5. Butterfly Valves – Air Service (Section 40 05 51 Process Valves)

   Manufacturer

   DeZurik $_____

   _____ $_____ $_____

[Intentionally left blank]

Bid Proposal

Owner:	City of Hart			
Owner Address:	407 State St. Hart, MI 49420			
Project Title:	Wastewater System Improvements - BioPure Treatment Facility			
Bid Date & Time:	May 16, 2023 at 2:00 pm	Project #:	2211159	SRF Project No.: 5845-01 EDA Award No. 06-79-06430

MAJOR EQUIPMENT (continued)

6. Electromagnetic Flowmeters (Section 40 91 00 Process Instrumentation)

   Manufacturer

   Rosemount $_____

   _____ $_____ $_____

7. Wastewater Screen Equipment (Section 46 21 33 Rotary Drum Screen)

   Manufacturer

   Huber $_____

   _____ $_____ $_____

8. Septage Receiving Equipment (Section 46 21 83 Septage Receiving Equipment)

   Manufacturer

   ScreenCO Systems $_____

   _____ $_____ $_____

9. Grit Removal Equipment (Section 46 23 00 Grit Removal and Handling Equipment)

   Manufacturer

   Lakeside $_____

   _____ $_____ $_____

[Intentionally left blank]

Bid Proposal

Owner:	City of Hart			
Owner Address:	407 State St. Hart, MI 49420			
Project Title:	Wastewater System Improvements - BioPure Treatment Facility			
Bid Date & Time:	May 16, 2023 at 2:00 pm	Project #:	2211159	SRF Project No.: 5845-01 EDA Award No. 06-79-06430

MAJOR EQUIPMENT (continued)

10. Grit Pump (Section 46 23 00 Grit Removal and Handling Equipment)

    Manufacturer

    Gorman-Rupp $_____

    _____ $_____ $_____

11. Floating Mechanical Aerators (Section 46 51 13 Floating Mechanical Aerators)

    Manufacturer

    Aqua-Aerobic Systems $_____

    _____ $_____ $_____

12. Flexible Membrane Tube Diffusers & Accessories (Section 46 51 31 Flexible Membrane Tube Diffusers)

    Manufacturer

    Nexom/EDI $_____

    _____ $_____ $_____

[Intentionally left blank]

Bid Proposal Checklist

Owner:	City of Hart	
Project Title:	Wastewater System Improvements - BioPure Treatment Facility	
Project #:	2211159	SRF Project No.: 5845-01 EDA Award No. 06-79-06430

This checklist is for the bidder's convenience and the Engineer's use. It should be reviewed thoroughly before submitting a bid.

- ☐ Bid submitted on time.
- ☐ Bid surety properly completed and enclosed.
- ☐ Addenda, if applicable, have been acknowledged and any revisions to the proposal completed.
- ☐ Bid proposal legally signed in ink.
- ☐ Contract Prices are completed in ink.
- ☐ EDA Forms properly completed and enclosed.
- ☐ Completed Debarment Certification documents:
    1. Certification Regarding Debarment, Suspension, and other Responsibility Matters

[Intentionally left blank]

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between City of Hart, 407 State Street, Hart, MI 49420 ("Owner") and _____ ("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: *Wastewater System Improvements – BioPure Treatment Facility*

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows:

- *Construction of a Headworks Building including a screening system and grit removal system;*
- *Dividing the existing biosolids basin into a biosolids basin and an aeration basin, including floating air laterals, diffusers, an outlet structure, and aeration blower piping modifications;*
- *Dividing the existing polishing pond into a polishing pond and a biosolids basin;*
- *Addition of mechanical aerating mixers to the biosolids basins;*
- *Rehabilitation of the Polishing Pond Pump Station and force main;*
- *Construction of a new Biosolids Pump Station and force main;*
- *Improvements to the Rapid Infiltration Basins (RIBs);*
- *Construction of one (1) secondary clarifier, two (2) return activated sludge pumps and associated piping and appurtenances;*

Also included is all associated equipment, valves, piping, mechanical, electrical, controls, and site work. Wastewater System Improvements – BioPure Treatment Facility

ARTICLE 3—ENGINEER

3.01 The Owner has retained Prein&Newhof, 4910 Stariha Drive, Muskegon, MI 49441 ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by Prein&Newhof.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Dates*

A. The Work will be substantially complete on or before **December 31, 2025** and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before **December 31, 2025**.

~~4.03 *Contract Times: Days*~~

~~A. The Work will be substantially complete within **[ ]** days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within **[ ]** days after the date when the Contract Times commence to run.~~

~~4.04 *Milestones*~~

~~A. Parts of the Work must be substantially completed on or before the following Milestone(s):~~

~~1. Milestone 1 **[event & date/days]**~~

~~2. Milestone 2 **[event & date/days]**~~

~~3. Milestone 3 **[event & date/days]**~~

4.05 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner $**2,000** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as

duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $**2,000** for each day that expires after such time until the Work is completed and ready for final payment.

3. ~~*Milestones:* Contractor shall pay Owner $**[*]** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved, or until the time specified for Substantial Completion is reached, at which time the rate indicated in Paragraph 4.05.A.1 will apply, rather than the Milestone rate.~~

4. Liquidated damages for failing to timely attain Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

C. ~~*Bonus:* Contractor and Owner further recognize the Owner will realize financial and other benefits if the Work is completed prior to the time specified for Substantial Completion. Accordingly, Owner and Contractor agree that as a bonus for early completion, Owner shall pay Contractor $**[ ]** for each day prior to the time specified above for Substantial Completion (as duly adjusted pursuant to the Contract) that the Work is substantially complete. The maximum value of the bonus will be limited to $**[ ]**.~~

4.06 *Special Damages*

A. Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.

B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

C. The special damages imposed in this paragraph are supplemental to any liquidated damages for delayed completion established in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. For all Work other than Unit Price Work, a lump sum of $_____

All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.

~~B. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item).~~

~~Unit Price Work~~					
~~Item No.~~	~~Description~~	~~Unit~~	~~Estimated Quantity~~	~~Unit Price~~	~~Extended Price~~
				~~$~~	~~$~~
				~~$~~	~~$~~
				~~$~~	~~$~~
				~~$~~	~~$~~
				~~$~~	~~$~~
~~Total of all Extended Prices for Unit Price Work (subject to final adjustment based on actual quantities)~~					~~$~~

~~The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.~~

~~C. Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment) $**[ ]**.~~

D. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the 1st day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments

previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. **90** percent of the value of the Work completed (with the balance being retainage).

1) If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and

b. **0** percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **98** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **100** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 *Interest*

A. All amounts not paid when due will bear interest at the rate of **0** percent per annum.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual.
6. Drawings (not attached but incorporated by reference) consisting of 85 sheets with each sheet bearing the following general title: Wastewater System Improvements.

7. Addenda (numbers __ to __, inclusive).
8. Exhibits to this Agreement (enumerated as follows):
    a. **Contractor's Bid (pages 1 to 6, inclusive)**
    b. Insurance Specifications (pages 1 to 11, inclusive).
    c. The 2020 Standard Specifications for Construction adopted by the Michigan Department of Transportation are hereby incorporated into these contract documents.
9. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.
    d. Field Orders.
    e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.

5. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

6. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

7. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

8. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

9. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

10. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

Owner:	Contractor:
City of Hart *(typed or printed name of organization)*	_____ *(typed or printed name of organization)*
By: _____ *(individual's signature)*	By: _____ *(individual's signature)*
Date: _____ *(date signed)*	Date: _____ *(date signed)*
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)* *(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*
Attest: _____ *(individual's signature)*	Attest: _____ *(individual's signature)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address for giving notices: 407 State Street Hart, MI 49420	Address for giving notices:
Designated Representative:	Designated Representative:
Name: _____ *(typed or printed)*	Name: _____ *(typed or printed)*
Title: _____ *(typed or printed)*	Title: _____ *(typed or printed)*
Address:	Address:
Phone:	Phone:
Email:	Email:
(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)	License No.: _____ *(where applicable)* State:

[Intentionally left blank]

PERFORMANCE BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: City of Hart	Description *(name and location)*:
Mailing address *(principal place of business)*:	BioPure Treatment Facility
407 State Street	
Hart, MI 49420	Contract Price:
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☒ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____	_____
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature)(Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:

    3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

    3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

    3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

    5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

    5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

    5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

    5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with

said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: **None**

PAYMENT BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: City of Hart Mailing address *(principal place of business)*: 407 State Street Hart, MI 49420	Description *(name and location)*: BioPure Treatment Facility Contract Price: Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☒ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____	_____
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature)(Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond will arise after the following:

    5.1. Claimants who do not have a direct contract with the Contractor

        5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2. Pay or arrange for payment of any undisputed amounts.

    7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

    16.1. *Claim*—A written statement by the Claimant including at a minimum:

        16.1.1. The name of the Claimant;

        16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

        16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

        16.1.4. A brief description of the labor, materials, or equipment furnished;

16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: **None**

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by

Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or

communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part

thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take

precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
2. Abnormal weather conditions;
3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and
4. Acts of war or terrorism.

D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;
2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the

effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise;

(b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
2. is of such a nature as to require a change in the Drawings or Specifications;
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement

to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

    c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

    a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

    b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

    c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities.

Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written

statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

   a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

   b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

   c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the

required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at

Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

    a. in the exercise of reasonable judgment Engineer determines that the proposed item:

        1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

        2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

        3) has a proven record of performance and availability of responsive service; and

        4) is not objectionable to Owner.

    b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

        1) there will be no increase in cost to the Owner or increase in Contract Times; and

        2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

   a. will certify that the proposed substitute item will:

      1) perform adequately the functions and achieve the results called for by the general design;

      2) be similar in substance to the item specified; and

      3) be suited to the same use as the item specified.

   b. will state:

      1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

      2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

      3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

   c. will identify:

      1) all variations of the proposed substitute item from the item specified; and

      2) available engineering, sales, maintenance, repair, and replacement services.

   d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in

Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or

otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any

license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to

such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any

of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer

may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two

resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity

directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be

set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
2. An itemization of the specific matters to be covered by such authority and responsibility; and
3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.
2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any

Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving

the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal

and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe

benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

        1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

    c. *Construction Equipment Rental*

        1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment,

machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved

by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then

Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work;

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

a. all documentation called for in the Contract Documents;

b. consent of the surety, if any, to final payment;

c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment

bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;

2. correct such defective Work;

3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as

to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be

as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

SUPPLEMENTARY CONDITIONS

Wastewater System Improvements - BioPure Treatment Facility

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Caption and Introductory Statements

Supplementary Conditions

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC C-700 (2018 Edition). All provisions which are not so amended or supplemented remain in full force and effect.

Unless otherwise noted, the terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

ADDITIONS, DELETIONS AND CHANGES TO GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

SC-1.01 *Defined Terms*

SC-1.01 Add the following new paragraph immediately after Paragraph 1.01.A.22:

22.1 *Falsework*--temporary construction work on which a main work is wholly or partly built and/or supported until the main work is strong enough to support itself.

SC-1.01 Add the following new paragraph immediately after Paragraph 1.01.A.32:

32.1 *Project Manual* – the written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

SC-1.02 *Terminology*

SC-1.02 Add the following new sentence immediately after the last sentence in Paragraph 1.02.B:

The use of any such term or adjective is not intended to and shall not be effective to relieve the Contractor of responsibility to comply with all Laws and Regulations applicable to the performance of the Work, or to perform the Work in accordance with the provisions of Article 7, or to comply with any other provision of the Contract Documents.

ARTICLE 2 - PRELIMINARY MATTERS

SC-2.03 *Before Starting Construction*

SC-2.03 Delete Paragraph 2.03.A in its entirety and insert the following in its place:

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement, Contractor shall submit to Owner and Engineer for timely review:

1. A preliminary Progress Schedule indicating the times (number of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. A preliminary Schedule of Submittals; and

3. A preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

SC-2.05 *Acceptance of Schedules*

SC-2.05 Delete Paragraph 2.05.A in its entirety and insert the following in its place:

A. Upon Owner's, Engineer's or Contractor's request at least ten days before submission of the first Application for Payment a conference, attended by Contractor, Owner, Engineer and others as appropriate, will be held to review for acceptability to Owner as provided below the schedules submitted in accordance with paragraph 2.03.A. If a schedule is not acceptable, Contractor shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. Upon notice by Owner, no progress payment shall be made to Contractor until acceptable

schedules are submitted and accepted by Owner.

1. The Progress Schedule will be acceptable to Owner if it provides an orderly progression of the Work to completion within any specified Milestones and the Contract Time, and if acceptable to Engineer. Such acceptance will not impose on Owner or Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Owner if acceptable to Engineer and if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Owner as to form and substance if it is acceptable to Engineer and if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

SC-3.01 *Intent*

SC-3.01 Add the following new sentence immediately after the last sentence in Paragraph 3.01.B:

Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

SC-3.02 *Reference Standards*

SC-3.02.A.2 Delete Paragraph 3.02.A.2 in its entirety and insert the following in its place:

No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision

or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

SC-3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

SC-3.03 Delete Sub-Paragraph 3.03.A.3 in its entirety and insert the following in its place:

3. Contractor shall not be entitled to any increase in the Contract Amount or Contract Time for any conflicts, errors, ambiguities or discrepancies in the Contract Documents that were known, or that should have been known to Contractor, or which could have been discovered by Contractor as part of its review of the bidding requirements and Contract Documents prior to bidding or its review of the Contract Documents prior to undertaking any part of the Work.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.01 *Commencement of Contract Times; Notice to Proceed*

SC-4.01 Delete Paragraph 4.01.A in its entirety and insert the following in its place:

A. The Contract Times will commence to run on the day indicated in the Notice to Proceed.

SC-4.05 *Delays in Contractor's Progress*

SC-4.05 Add the following new paragraph immediately after Paragraph 4.05.G

H. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under Paragraph 4.05 within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 - SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

SC-5.03 *Subsurface and Physical Conditions*

SC-5.03.A Delete Paragraph 5.03.A in its entirety and insert the following in its place:

A. *Reports and Drawings:* The Contract Documents may identify:

1. Those soil borings, plans, drawings, surveys or other reports of explorations of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Contract Documents;

2. Those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site, (Except Underground Facilities) that Engineer has used in preparing the Contract Documents; and

3. Technical Data contained in such *Reports and Drawings.*

The soil borings, plans, drawings, surveys, technical data, and other documents referenced in Paragraphs 5.03.A.1, 2 and 3 are collectively called "*Reports and Drawings.*"

SC-5.03.C Delete Paragraph 5.03.C in its entirety and insert the following in its place:

C. *Reliance by Contractor Not Authorized.* Contractor may not rely upon the *Reports and Drawings* referenced in 5.03.A or make any claim against Owner, Engineer, or any of Owner's or Engineer's Consultants or Subcontractors related to the *Reports and Drawings*. This limitation includes but is not limited to:

1. The accuracy or completeness of such *Reports and Drawings* for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

2. The accuracy or completeness of other data, interpretations, opinions, and information contained in, shown on, or indicated in the *Reports and Drawings*; or

3. Any Contractor interpretation of or conclusion drawn from any of the *Reports and Drawings* or any other Technical Data, data, interpretations, opinions or information referenced in the *Reports and Drawings.*

The *Reports and Drawings,* including the information contained therein, are offered to the Contractor only as information relied upon by Engineer in the preparation of the Contract Documents, and the Contractor is solely responsible for confirming actual conditions. Neither the Engineer nor the Owner, nor the Consultants or Subcontractors of either have any responsibility for any conclusion, interpretation or analysis contained therein or made by the Contractor based upon the Contractor's review of the Reports *and Drawings*.

Neither Owner nor Engineer has any responsibility for and does not warrant that the soils or water table encountered during construction will be as shown in the *Reports and Drawings*.

SC-5.03.D Delete Paragraph 5.03.D in its entirety and insert the following in its place:

D. Contractor warrants that before submitting a bid the Contractor has determined the soil and subsoil conditions, including the water table elevation and the conditions to be encountered by Contractor in the performance of the Work and that said conditions and factors have been evaluated by Contractor and incorporated into his Contract with Owner. Contractor further warrants that the Contractor is fully aware of the soil conditions, subsoil conditions, water table and all applicable State and Federal Regulations related to the excavation, removal, transportation, placement and relocation of the materials involved in the Work to be performed by the Contractor and that Contractor will complete the Work under whatever

conditions he may encounter or create without extra cost, expense to or claim against the Owner or Engineer, their Consultants or Subcontractors.

Contractor has identified all locations where the Contractor's operations are near public roadways, the properties of railroads or contiguous physical structures. Work shall not take place until Contractor has made all arrangements necessary to identify the location and/or elevation of the roadways, the properties of railroads or contiguous physical structures and foundation or appurtenances and has taken all necessary steps to protect the roadways, the properties of railroads or contiguous physical structures from damage. Contractor is solely responsible for any and all damage to roadways, the properties of railroads or contiguous physical structures and any personal injury, death or property damage or consequential damages arising from Contractor's operations.

SC-5.04 *Differing Subsurface or Physical Conditions*

SC-5.04.A Delete Paragraph 5.04.A in its entirety and insert the following in its place:

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to require a change in the Contract Documents; or

2. is of an unusual nature and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, within 48 hours after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor

shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so. If notice as provided in the section is not given, no change in Contract Price shall be considered or allowed.

SC-5.04.B Delete Paragraph 5.04.B in its entirety and insert the following in its place:

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 5.04.A, Engineer will review the information provide by Contractor. If Engineer, in Engineer's sole discretion, determines that additional explorations and/or tests are needed to evaluate Contractor's belief that there are differing subsurface or physical conditions, then Contractor, at Contractor's sole expense, shall promptly undertake those additional explorations and/or tests, and provide the results to Engineer. Engineer will then review the information provided by Contractor along with any other information Engineer believes is pertinent, and advise Owner in writing (with a copy to Contractor) of Engineer's findings, conclusions and recommendations.

If after receipt of written notice as required by Paragraph 5.04.A, Engineer, in Engineer's sole discretion, determines that additional explorations and/or tests are not needed to evaluate Contractor's belief that there are differing subsurface or physical conditions, Engineer will review the information provided by Contractor, along with any other information Engineer believes is pertinent, and advise Owner in writing (with copy to Contractor) of Engineer's findings, conclusions and recommendations.

Owner reserves the right at its own expense to undertake additional exploration and/or testing. This reservation in no way waives the responsibility of the Contractor to undertake additional explorations and/or tests, if required, as set forth above.

SC-5.05 *Underground Facilities*

SC-5.05.A Delete Paragraph 5.05.A in its entirety and insert the following in its place:

A. *Contractor's Responsibilities*: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on

information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others.

1. The Underground Facilities shown on or indicated in the Contract Documents are located according to the information available to the Engineer at the time of the preparation of the Contract Documents. Neither the Engineer nor the Owner guarantee the accuracy or completeness of any such information or data, including but not limited to information provided by the Owner;

2. The Contractor is solely responsible for identifying the actual location of all Underground Facilities and shall verify the location and/or elevations of the Underground Facilities prior to undertaking construction;

3. At all locations where the Contractor's operations are near, will cross or contact Underground Facilities, no part of the Work shall commence until Contractor has made all arrangements necessary to identify the location and/or elevation of the Underground Facility, including contacting MISS DIG, has notified the owner of the Underground Facility, and has taken all necessary steps to protect the Underground Facility from damage.

4. The cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

    a. reviewing and checking all information and data regarding Underground Facilities at the Site;

    b. complying with applicable state and local utility damage prevention Laws and Regulations;

    c. locating all Underground Facilities shown or indicated in the Contract Documents;

    d. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the

Work, by exposing such Underground Facilities during the course of construction;

e. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction;

f. the safety and protection of all such Underground Facilities and related above ground structures, including but not limited to shoring, bracing, supporting and maintenance of all Underground Facilities and related above ground structures affected by the Contractor's operations;

g. repairing any damage to Underground Facilities and related above ground structures resulting from the Work; and

h. any personal injury, death or property damage or consequential damages arising from Contractor's Work.

5. In the event of the interruption of or damage to an Underground Facility as the result of Contractor's operations, the Contractor shall immediately notify the Underground Facility owner and shall take all steps necessary to cooperate with and assist the Underground Facility owner in the restoration and repair of the Underground Facility. Said repair work shall be continuous and shall not result in any delay of the Project or increased cost or expense to Owner, or claim against Owner, Engineer or their Consultants.

SC-5.05.B Delete Paragraph 5.05.B in its entirety and insert the following in its place:

B. *Notice by Contractor*: If an Underground Facility is uncovered or revealed at or adjacent to the Site which was not shown or indicated in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required paragraph 7.15), identify the owner of such Underground Facility

and give written notice to that owner and to Owner and Engineer.

SC-5.05.C Delete Paragraph 5.05.C in its entirety and insert the following in its place:

C. *Engineer's Review*: Engineer will review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. If Engineer concludes that a change in the Contract Documents is required, Engineer shall prepare recommendations to the Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. At all times, Contractor shall be solely responsible for the safety and protection of such Underground Facility.

SC-5.05.F. Delete Paragraph 5.05.F.1 in its entirety and insert the following in its place:

F. *Possible Price and Times Adjustment*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated in the Contract Documents, subject to the following:

a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

d. Contractor gave the notice required in Paragraph 5.05.B.

SC-5.06 *Hazardous Environmental Conditions at Site*

SC-5.06.A Delete Paragraph 5.06.A in its entirety and insert the following in its place:

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. The following reports regarding Hazardous Environmental Conditions at the Site were utilized by the Engineer in the preparation of the Contract Documents:

a. *None*

2. The following drawings regarding Hazardous Environmental Conditions at the Site were utilized by the Engineer in the preparation of the Contract Documents:

a. *None*

3. Technical Data contained in such *Reports and Drawings.*

SC-5.06.B Delete Paragraph 5.06.B in its entirety and insert the following in its place:

B. *Reliance by Contractor Not Authorized:* Contractor may not make any Claim against Owner, Engineer or the Consultants of either with respect to:

1. The completeness of such reports, drawings and/or Technical Data, for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, the cost of Work and safety precautions and programs incident thereto; or

2. The accuracy of any Technical Data, or any other data, interpretations, opinions and information contained in such reports or shown or indicated on such drawings; or

3. Any Contractor interpretation of or conclusion drawn from any

such report, drawing or Technical Data.

ARTICLE 6 - BONDS AND INSURANCE

6.02 *Insurance—General Provisions*

SC-6.02 Delete Paragraph 6.02.A in its entirety and insert the following in its place:

A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Insurance Specification.

SC-6.02 Delete Paragraphs 6.02.B through 6.02.N in their entirety and replace with Insurance Specification.

6.03 *Contractor's Insurance*

SC-6.03 Delete Paragraph 6.03.A in its entirety and insert the following in its place:

A. *Required* Insurance: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Insurance Specification.

SC-6.03 Delete Paragraphs 6.03.B through 6.03.C in their entirety and replace with Insurance Specification.

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Delete the last sentence of Paragraph 6.04.A and insert the following in its place:

The specific requirements applicable to the builder's risk insurance are set forth in the Insurance Specification.

SC-6.04 Delete Paragraphs 6.04.B through 6.04.E in their entirety and replace with Insurance Specification.

6.05 *Property Losses; Subrogation*

SC-6.05 Delete Paragraphs 6.05.A through 6.05.D in their entirety and replace with Insurance Specification.

6.06 *Receipt and Application of Property Insurance Proceeds*

SC-6.06 Delete Paragraphs 6.06.A through 6.06.C in their entirety and replace with Insurance Specification.

ARTICLE 7 - CONTRACTOR'S RESPONSIBILITIES

SC-7.01 *Contractor's Means and Methods of Construction*

SC-7.01.A Add the following new sentence immediately after the last sentence in 7.01.A:

Nothing in the design, specifications or Contract Documents shall be deemed to constitute a specific means, method, technique, sequence, or procedure of construction. Contractor shall be solely responsible for ensuring that the completed Work conforms accurately to the Contract Documents.

SC-7.05 *"Or-Equals"*

SC-7.05.A Add the following sub-paragraph immediately after Paragraph 7.05.A.1.b.2:

3) the item will be functionally equal to the named item of material or equipment. Contractor warrants and assumes sole responsibility for the adequacy, performance and functioning of the "or-equal" material or equipment.

SC-7.06 *Substitutes*

SC-7.06.A.3.f Add the following sub-paragraph immediately following paragraph 7.06.A.3.d:

f. Contractor warrants that, if approved and incorporated into the Work, the "substitute item" will be functionally equal to the named item of material or equipment. Contractor assumes sole responsibility for the adequacy, performance and functioning of the "substitute" item of material or equipment.

SC-7.07 *Concerning Subcontractors and Suppliers*

SC-7.07.D Delete Paragraph 7.07.D in its entirety and replace with the following paragraph:

D. No later than two (2) business days after the bid opening, the Contractor shall submit to the Owner and Engineer for acceptance a list of the names and addresses of the Contractor's Subcontractors, Suppliers and such other individuals and entities as the Owner requests.

SC-7.07 Add the following sub-paragraphs immediately following paragraph 7.07.M:

N. Contractor shall require all Subcontractors, prior to commencement of any Work by the Subcontractor, to secure and keep in force the insurance coverages set forth in and required by the Insurance Specification.

O. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors and Suppliers, whether initially or as a replacement, performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.

SC-7.08 *Patent Fees and Royalties*

SC-7.08.B Delete paragraph 7.08.B in its entirety.

SC-7.11 *Laws and Regulations*

SC-7.11.D Add the following new paragraph immediately after Paragraph 7.11.C:

D. Contractor shall be solely responsible for compliance with all Federal and State Occupational Safety and Health Act ("OSHA") requirements related to the Work and the Site, including, if applicable, the requirements of the Michigan Occupational Safety and Health Act ("MIOSHA"). Neither Owner nor Engineer shall have any responsibility for construction site safety or OSHA or MIOSHA compliance. Contractor will indemnify and hold harmless Owner and Engineer from all claims, costs, fees, fines, penalties and expenses (including but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court, administrative proceeding, and dispute resolution costs) related in any way to claims related

to construction site safety, OSHA or MIOSHA violations or charges.

SC-7.13 *Safety and Protection*

SC-7.13.A Amend the first sentence of Paragraph 7.13.A to read as follows:

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work, including but not limited to the enforcement of safety precautions and programs of all Subcontractors.

SC-7.13.D Amend Paragraph 7.13.D to read as follows:

E. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense.

SC-7.16 *Submittals*

SC-7.16.B.1 Amend paragraph 7.16.B.1.a to read as follows:

a. Contractor shall submit to Engineer for approval eight (8) copies of all shop drawings.

SC-7.16.B.2 Amend paragraph 7.16.B.2.a to read as follows:

a. Contractor shall submit to Engineer for approval eight (8) duplicates of each Sample.

SC-7.16.E Add the following new paragraph immediately after Paragraph 7.16.E.1.d:

e. Contractor shall submit to Engineer for approval eight (8) duplicates of each submittal.

SC-7.17 *Contractor's General Warranty and Guarantee*

SC-7.17.A Delete Paragraph 7.17.A in its entirety and replace with the following paragraph:

Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee. Contractor's warranty and guaranty that all Work will be in accordance with the Contract Documents and will not be defective includes but is not limited to all materials and equipment incorporated into the Work. Unless a longer duration is required by the Project Specifications, Contractor's warranty and guaranty that all Work will be in accordance with the Contract Documents and will not be defective will extend for at least one year after the date of Substantial Completion.

SC-7.17.D.8 Amend paragraph 7.17.D.8 to read as follows:

8. Any inspection, test, review, or approval by Engineer, the Resident Project Representative (if one is assigned to the Site), or by others;

SC-7.17.D.9 Amend Paragraph 7.17.D.9 to read as follows:

9. Any correction of defective Work by Owner; or

SC-7.17.D.10 Add the following new paragraph immediately after Paragraph 7.17.D.9:

10. Any acceptance by Owner, or any failure to do so.

SC-7.19 *Delegation of Professional Design Services*

SC-7.19.B Add the following new sentence immediately after the last sentence in 7.19.B:

The design professional must be licensed in the state or states where the Project is located.

SC-7.19.D Delete Paragraph 7.19.D in its entirety and replace with the following paragraph:

Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, drawings, calculations, specifications, Submittals, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

SC-9.06 *Insurance*

SC-9.06.A. Delete Paragraph 9.06.A in its entirety and replace with the following paragraph:

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in the Insurance Specifications.

ARTICLE 10 - ENGINEER'S STATUS DURING CONSTRUCTION

SC-10.01 *Owner's Representative*

SC-10.01.A Delete Paragraph 10.01.A in its entirety and insert the following in its place:

A. Engineer will be Owner's representative during the construction period. The Engineer will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents. The authority and responsibilities of the Engineer as set forth in the Contract Documents shall not be restricted, extended or otherwise modified without the written consent of the Engineer and the Owner. Nothing in the Contract Documents shall create for the benefit of the Contractor, any Subcontractor, Supplier or other individual or entity, any contractual relationship between Engineers and any such Contractor, Subcontractor, Supplier or other individual or entity.

SC-10.02 *Visits to Site*

SC-10.02.A Amend Paragraph 10.02.A by striking the following words from the first sentence:

"at intervals appropriate to the various stages of construction"

SC-10.03 *Resident Project Representative*

SC-10.03.C Add the following new paragraphs immediately after Paragraph 10.03.C:

C. If Engineer furnishes a Resident Project Representative (RPR), the RPR

will be Engineer's employee or agent at the Site. The RPR's authority and responsibility is expressly limited to making observations of the progress that has been made and the quality of the various aspects of Contractor's executed Work, and reporting same to Engineer. RPR will not be required to make exhaustive or continuous observations or inspections on the Site to check the quality or quantity of the Work. RPR's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. In addition to the limitations set forth in Paragraph 10.07, The RPR does not have the authority or responsibility to:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, Suppliers, or Contractor's superintendent.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work.

5. Advise on, issue directions regarding, or assume control over safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Accept Shop Drawing or Sample submittals.

8. Authorize Owner to occupy the Project in whole or in part.

9. Interpret for Contractor or Owner any provision of the Contract Documents.

10. Stop the Work for any reason.

SC-10.07 *Limitations on Engineer's Authority and Responsibilities.*

SC-10.07.B Add the following sentence immediately after the last sentence in Paragraph 10.07.B:

Engineer may not stop the work or interfere with the progress of the Work. No decision made by the Engineer in good faith either to exercise or not exercise any authority or responsibility delegated to Engineer in the Contract Documents or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall be construed as interference with the progress of the Work. Engineer shall have no authority or responsibility to recommend alternate or possible safety activities or changes for the safety of the project, Contractor, Subcontractors, Suppliers, Owner, employees, third persons or their property.

SC-10.07.F Add the following new paragraph immediately after Paragraph 10.07.E:

F. Engineer will not be responsible for Contractor's failure to pay Subcontractors, Suppliers, employees, taxes, fees, permits, patent fees, copyright fees, royalties, licenses or monies due to any individual or entity.

SC-15.01 *Progress Payments*

SC-15.01.C Delete Paragraph 15.01.C.3.a and insert the following in its place:

a. Inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work; or

SC-15.01.C Delete the period at the end of the sentence in Paragraph 15.01.C.4.e and insert the following in its place:

, or

SC-15.01.C Add the following new paragraphs immediately after Paragraph 15.01.C.4.e:

f. for Contractor's failure to construct the Work or any part of the Work in conformance with the Contract Documents, or

g. for defective Work.

SC-15.04 *Partial Use or Occupancy*

SC-15.04 Delete Paragraph 15.04.A.4 in its entirety and insert the following in its place:

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of the Insurance Specifications regarding builder's risk or other property insurance.

SC-15.07 *Waiver of Claims*

SC-15.07.A Delete Paragraph 15.07.A in its entirety and insert the following in its place:

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising (1) from unsettled Liens, (2) from defective Work, (3) from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, (4) from outstanding Claims by Owner, (5) from Contractor's continuing obligations under the Contract Documents, and (6) from late completion by Contractor, including without limitation liquidated damages or other damage.

ARTICLE 17 – FINAL RESOULTION OF DISPUTES

SC-17.01 *Methods and Procedures*

SC-17.01.B Delete Paragraph 17.01.B.1 in its entirety and insert the following in its place:

1. At Owner's sole option, Owner may demand in writing arbitration of the dispute;

SC-17.01.C Add the following new paragraph immediately after Paragraph 17.01.B

SC-17.01.C *Arbitration of Claims at Election of Owner*

1. If the Owner elects in writing to demand arbitration as set forth in Paragraph 17.01.1, the dispute will be decided by arbitration in accordance with the rules of the American Arbitration Association in effect as of the Effective Date of the Agreement

2. The demand for arbitration will be filed in writing with the Contractor

and with the selected arbitrator, and a copy will be sent to Engineer for information.

3. The award rendered by the arbitrator(s) shall be consistent with the agreement of the parties, in writing, and include: (i) a concise breakdown of the award; and (ii) a written explanation of the award specifically citing the Contract Document provisions deemed applicable and relied on in making the award.

4. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal except as provided by the controlling law governing vacating or modifying an arbitration award.

5. The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor.

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

SC-18.01 Delete Paragraph 18.01.A.3 in its entirety.

INSURANCE SPECIFICATION

Insurance Required to be Purchased and Maintained by the Contractor

Contractor shall comply with all requirements of this Insurance Specification. Contractor shall purchase and maintain (i.e. keep in force) insurance which conforms to the requirements of this Insurance Specification.

1.1 Insurance—General Provisions

1.1.1 Contractor shall obtain and maintain insurance as required in this Insurance Specification.

1.1.2 All insurance required by the Contract to be purchased and maintained by Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverage's. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

1.1.3 Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Insurance Specification, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverage's, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

1.1.4 Failure of Owner to demand such certificates or other evidence of the Contractor's full compliance with these insurance requirements, or failure of Owner to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the Contractor's obligation to obtain and maintain such insurance.

1.1.5 If Contractor does not purchase or maintain all of the insurance required of Contractor by the Contract, Contractor shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

1.1.6 If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16 of the General Conditions of the Contract.

1.1.7 Without prejudice to any other right or remedy, if Contractor has failed to obtain required insurance, Owner may elect to obtain equivalent insurance to protect Owner's interests at the expense of the Contractor, and the Contract Price shall be adjusted accordingly.

1.1.8 Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

1.1.9 The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

1.2 Contractor's Insurance - Liability

1.2.1 **Owner's & Contractor's Protective Liability**: Contractor shall purchase and maintain an Owner's & Contractor's Protective Liability Policy ("OCP" Policy). The OCP policy shall name the Owner, the Engineer, their consultants, agents, and employees, as the insureds (hereinafter collectively called the "named insureds"). The OCP policy will protect the named insureds for any actual or alleged liability arising out of the work performed by the Contractor, the Subcontractor(s), or Suppliers, on this Project. The OCP policy will provide primary, non-contributing coverage.

1.2.2 **Workers' Compensation and Employer's Liability**: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

1.2.2.1 Claims under workers' compensation, disability benefits, and other similar employee benefit acts.

1.2.2.2 United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

1.2.2.3 Claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

1.2.2.4 Foreign voluntary worker compensation (if applicable).

1.2.3 **Commercial General Liability—Claims Covered**: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

1.2.3.1 Claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.

1.2.3.2 Claims for damages insured by reasonably available personal injury liability coverage.

1.2.3.3 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

1.2.4 Commercial General Liability—Form and Content: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverage's and endorsements:

1.2.4.1 Products and completed operations coverage: Such insurance shall be maintained for three years after final payment.

1.2.4.2 Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

1.2.4.3 Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

1.2.4.4 Premises/operations liability.

1.2.4.5 Personal and advertising injury.

1.2.4.6 Broad form property damage coverage.

1.2.4.7 Severability of interest (the CGL policy shall apply to each named insured as if that named insured was the only named insured and the policy shall apply separately to each insured against whom claim is made or suit is brought).

1.2.4.8 Underground, explosion, and collapse coverage.

1.2.4.9 Personal injury coverage, including employees (with no exclusions pertaining to employment).

1.2.4.10 Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

1.2.4.11 For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

1.2.5 **Automobile liability**: Contractor shall purchase and maintain comprehensive automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle, including owned, non-owned, and hired motor vehicles. In light of standard policy provisions concerning (a) loading and unloading, and (b) definitions pertaining to motor vehicles licensed for road use versus unlicensed or self-propelled construction equipment, it is recommended that the comprehensive automobile liability insurance policy and the commercial general liability policy be written by the same insurance carrier, though not necessarily in one the policy. The comprehensive automobile liability policy shall be written on an occurrence basis.

1.2.6 **Umbrella or excess liability**: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, aviation liability and automobile liability insurance described in the paragraphs above and in Section 1.2.10 below. The coverage afforded shall be at least as set for in Section 1.5.6. But if no box is checked in Section 1.5.6, then the umbrella/excess liability coverage limits will be $2,000,000 per occurrence and $2,000,000 general aggregate. The umbrella or excess liability insurance policy(ies) shall be an occurrence policy(ies)

1.2.7 **Contractor's pollution liability insurance**: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.

1.2.8 **Railroad Protective Liability**: Contractor shall purchase and maintain a Railroad Protective Liability policy, where such an exposure exists, to provide coverage in the name of each railroad company having jurisdiction over rights-of-way across which Work under the Contract Documents is to be performed. The form of the policy and the limits of liability shall be determined by the railroad company(ies) involved.

1.2.9 **Contractor's professional liability insurance**: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall purchase and maintain applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied

through the purchasing and maintenance of such insurance by such Subcontractor.

1.2.10 Aviation Liability Insurance: If required on this project as indicated by a check mark in Section 1.5.10, Contractor shall procure and maintain for the duration of the Contract insurance against claims for injuries to persons or damage to property which may arise from or in connection with the ownership, maintenance or use of Manned or Unmanned Aerial Vehicles, including but not limited to drone(s).

1.2.10.1 Minimum Scope and Limit of Insurance: Aviation Liability Insurance on an "occurrence" basis, including products and completed operations, property damage, bodily injury with limits no less than $1,000,000 per occurrence, and $2,000,000 in the aggregate. This coverage may also be provided by endorsement to the Contractor's Commercial General Liability policy.

1.3 The policies of insurance required to be purchased and maintained by the Contractor shall:

1.3.1 Additional insureds: The Contractor's commercial general liability, automobile liability, umbrella or excess, pollution liability policies and aviation liability insurance, shall include and list as additional insureds the Owner and Engineer, and the following individuals and entities:

Name	**Address**	**Telephone**
_____	_____	_____

The additional insured coverage shall include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and every additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements. Each additional insured endorsement shall state that each additional insured is entitled to the same rights as the named insured in the event of cancellation, including but not limited to prior notice of cancellation.

1.3.2 Deductible Liability: Any and all deductibles in the polices described in this Insurance Specification shall be assumed by, for the account of, and be the sole responsibility of Contractor. The amount of any deductible is subject to approval by the Owner.

1.3.3 Insurance will be primary: The insurance required to be purchased and maintained by the Contractor under this Insurance Specification shall be primary (i.e. pay first) as respects any insurance, self-insurance or self-retention maintained by the Owner, Engineer, and any other insureds. Any insurance, self-

insurance or self-retention maintained by the Owner, Engineer, or any other insureds, shall be in excess of the insurance purchased and maintained by the Contractor under this Insurance Specification, and shall not contribute with it.

1.3.4 Coverages: Include at least the specific coverage's provided in this Insurance Specification.

1.3.5 Minimum Limits: Be written for not less than the limits of liability provided in this Insurance Specification and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

1.3.6 Notice of Cancellation: Contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least ten (10) days prior written notice has been given to Contractor. Within three (3) days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

1.3.7 Duration: Remain in effect at least until final payment (and longer if expressly required in this Insurance Specification or the Supplementary Conditions) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

1.3.8 Be appropriate for the Work being performed and provide protection to Contractor, Owner, Engineer, and any other additional insured, from claims that may arise out of or result from Contractor's, Sub-contractor's or Supplier's performance of the Work, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

1.3.9 The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

1.4 Contractor's Insurance - Property

Builder's Risk: If required on this project as indicated by a check mark in Section 1.5.7, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in this Insurance Specification, or the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1.4.1.1 Include the interests of Owner, Contractor, Subcontractors, Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors, of any of them, and any other individuals or entities required by this Insurance Specification and/or the Supplementary Conditions to be

insured under such builder's risk policy. Each of whom shall be listed as a named insured (the parties required to be insured shall collectively be referred to as "insureds").

1.4.1.2 Be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by this Insurance Specification and/or the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

1.4.1.3 Cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

1.4.1.4 Cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

1.4.1.5 Extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

1.4.1.6 Extend to cover damage or loss to insured property while in transit.

1.4.1.7 Allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

1.4.1.8 Allow for the waiver of the insurer's subrogation rights, as set forth below.

1.4.1.9 Provide primary coverage for all losses and damages caused by the perils or causes of loss covered.

1.4.1.10 Not include a co-insurance clause.

1.4.1.11 Include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.

1.4.1.12 Include performance/hot testing and start-up.

1.4.1.13 Be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer, with 30 days written notice to each other Insured.

1.4.2 **Notice of Cancellation or Change**: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this section shall contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least ten (10) days prior written notice has been given to the purchasing policyholder. Within three (3) days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

1.4.3 **Deductibles**: Contractor shall pay for costs not covered because of the application of a policy deductible.

1.4.4 **Partial Occupancy or Use by Owner**: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04 of the General Conditions of the Contract, then Owner, through Contractor, will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

1.4.5 **Additional Insurance**: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this section, it may do so at Contractor's expense.

1.4.6 **Insurance of Other Property**: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

1.4.7 **Waiver of Rights:** All policies purchased in accordance with this Section 1.4, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in this Insurance Specification, or the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

1.4.8 Sub-Contractors Waiver of Rights

Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in this Insurance Specification or the Supplementary Conditions, as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

1.4.9 Receipt and Application of Property Insurance Proceeds

Any insured loss under the builder's risk and other policies of insurance required by this section will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by this section shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of the Contract or applicable Laws and Regulations.

If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

1.5 Minimum limits

1.5.1 The minimum limits for the insurance required by this Insurance Specification shall provide coverage for not less than the following amounts or greater where required by Laws or Regulations:

1.5.2 Owner's & Contractor's Protective Liability Policy

1.5.2.1	Each Occurrence	$1,000,000
1.5.2.2	General – Aggregate	$2,000,000

1.5.3 Contractor's Commercial General Liability Policy

1.5.3.1	General – Aggregate	$2,000,000
1.5.3.2	Products – Completed Operations Aggregate	$2,000,000
1.5.3.3	Personal and Advertising Injury	$1,000,000
1.5.3.4	Each Occurrence	$1,000,000
1.5.3.5	Fire damage	$50,000
1.5.3.6	Medical Expense	$5,000

1.5.4 Comprehensive Automobile Liability Policy (In accordance with Michigan's No Fault Statute)

1.5.4.1	Combined Single Limit of	$1,000,000

1.5.5 Worker's Compensation and Employer's Liability Policy

1.5.5.1	Michigan		Statutory Limits
1.5.5.2	Employer's Liability		
	1.5.5.2.1	Each accident	$ 500,000
	1.5.5.2.2	Disease – each employee	$ 500,000
	1.5.5.2.3	Disease – policy limit	$ 500,000
1.5.5.3	Federal, if applicable (e.g. FELA, Longshoreman's, etc. . . .)		Statutory Limits

1.5.5 Excess or Umbrella Liability Policy

Unless increased limits are required as checked below, the limits shall be:

1.5.6.1	General Aggregate	$2,000,000
1.5.6.2	Each Occurrence	$2,000,000

Owner may select increased limits for this project as checked below; otherwise, the above limits shall apply if neither below option is checked:

Option One	☐	
1.5.6.1	General Aggregate	$5,000,000
1.5.6.2	Each Occurrence	$5,000,000
Option Two	☐	
1.5.6.1	General Aggregate	$10,000,000
1.5.6.2	Each Occurrence	$10,000,000

1.5.7 Builder's Risk "all risk" policy — Full Replacement Cost

☒ Check if required

1.5.8 Contractor's Pollution Liability Policy — $1,000,000

1.5.9 Railroad Protective Liability — $

☐ Check if required — $

1.5.10 Aviation Liability Insurance

☐ Check if required

1.5.10.1	General – Aggregate	$2,000,000
1.5.10.2	Products – Completed Operations Aggregate	$2,000,000
1.5.10.4	Each Occurrence	$1,000,000

1.5.11 Other insurance

☐ Check if required (List Type) $

OP ID: JF

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER - - - - Phone: Fax:	CONTACT NAME: PHONE (A/C, No, Ext): FAX (A/C, No): E-MAIL ADDRESS: PRODUCER CUSTOMER ID #: _
INSURED Owner's Name and Address - -	INSURER(S) AFFORDING COVERAGE — NAIC # INSURER A : INSURANCE COMPANY _ AM BEST FINANCIAL INSURER B : INSURER C : INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
--	**GENERAL LIABILITY**						EACH OCCURRENCE	$ 1,000,000
-	[ ] COMMERCIAL GENERAL LIABILITY						DAMAGE TO RENTED PREMISES (Ea occurrence)	$
	[ ] CLAIMS-MADE [ ] OCCUR						MED EXP (Any one person)	$
-	[X] Owner's & Contractor's Prot						PERSONAL & ADV INJURY	$
-	[ ]						GENERAL AGGREGATE	$ 2,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						PRODUCTS - COMP/OP AGG	$
	[ ] POLICY [ ] PRO-JECT [ ] LOC							$
	AUTOMOBILE LIABILITY						COMBINED SINGLE LIMIT (Ea accident)	$
	[ ] ANY AUTO						BODILY INJURY (Per person)	$
	[ ] ALL OWNED AUTOS						BODILY INJURY (Per accident)	$
	[ ] SCHEDULED AUTOS						PROPERTY DAMAGE (Per accident)	$
	[ ] HIRED AUTOS							$
	[ ] NON-OWNED AUTOS							$
	[ ] **UMBRELLA LIAB** [ ] OCCUR						EACH OCCURRENCE	$
	[ ] **EXCESS LIAB** [ ] CLAIMS-MADE						AGGREGATE	$
	[ ] DEDUCTIBLE							$
	[ ] RETENTION $							$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y / N ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? [ ] **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	N / A					[ ] WC STATU-TORY LIMITS [ ] OTH-ER	
							E.L. EACH ACCIDENT	$
							E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

CERTIFICATE HOLDER

-

Contractor's Name and Address

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

OP ID: JF

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER - - - - Phone: Fax:	CONTACT NAME: PHONE (A/C, No, Ext): FAX (A/C, No): E-MAIL ADDRESS: PRODUCER CUSTOMER ID #: _
INSURED Contractor's Name and Address - -	INSURER(S) AFFORDING COVERAGE — NAIC # INSURER A : INSURANCE COMPANY _ AM BEST FINANCIAL INSURER B : INSURER C : INSURER D : INSURER E : INSURER F :

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
-	**GENERAL LIABILITY** X- COMMERCIAL GENERAL LIABILITY [ ] CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [ ] LOC						EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$ 1,000,000 $ 100,000 $ 5,000 $ 1,000,000 $ 2,000,000 $ 2,000,000
-	**AUTOMOBILE LIABILITY** X ANY AUTO X ALL OWNED AUTOS X SCHEDULED AUTOS X HIRED AUTOS X NON-OWNED AUTOS						COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$ 1,000,000 $ $ $
-	X **UMBRELLA LIAB** X OCCUR **EXCESS LIAB** [ ] CLAIMS-MADE DEDUCTIBLE RETENTION $						EACH OCCURRENCE AGGREGATE	$ 2,000,000 $ 2,000,000
-	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** Y / N ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? [ ] **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	N / A					X WC STATU-TORY LIMITS [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ 500,000 $ 500,000 $ 500,000
-	**Builder's Risk "ALL RISK" PROPERTY** **POLLUTION LIABILITY**						**CONTENTS**	**Full Replacement Cost** **$1,000,000**

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

Name of Additional Insured

CERTIFICATE HOLDER

-

Owner's Name and Address

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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GENERAL REQUIREMENTS

DIVISION 1

TABLE OF CONTENTS

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PART 1 - GENERAL

1.01 GENERAL

A. Related Sections: Some Sections of the Specifications (Divisions 1 through 48) may include a paragraph titled "Related Sections." This paragraph is an aid to the Project Manual user and is not intended to include all Sections that may be related. It is the Contractor's obligation to coordinate all Sections whether indicated under "Related Sections" or not.

1.02 SUMMARY OF WORK

A. The work covered by the Contract Documents consists of improvement to the **Hart BioPure Treatment Facility** located at **2687 N 88th Ave, Hart, MI 49420**. Included in this work is furnishing all supervision, labor, materials, equipment, activities and related costs necessary for completing the improvements. Work includes but is not limited to:

- Construction of a Headworks Building including a screening system and grit removal system;
- Dividing the existing biosolids basin into a biosolids basin and an aeration basin, including floating air laterals, diffusers, an outlet structure, and aeration blower piping modifications;
- Dividing the existing polishing pond into a polishing pond and a biosolids basin;
- Addition of mechanical aerating mixers to the biosolids basins;
- Rehabilitation of the Polishing Pond Pump Station and replacement of a portion of the force main;
- Construction of a new Biosolids Pump Station and force main;
- Improvements to the Rapid Infiltration Basins (RIBs);
- Construction of one (1) secondary clarifier, two (2) return activated sludge pumps and associated piping and appurtenances;

  Also included is all associated equipment, valves, piping, mechanical, electrical, controls, and site work.

B. The Contractor shall visit the site of the work and shall completely inform himself relative to construction hazards and procedure, labor, and all other conditions and factors, local and otherwise, which would affect execution and completion of the work and its cost. Such considerations shall include the arrangement and condition of the existing structures and facilities, the availability and cost of labor and facilities for transportation, handling and storage of materials and equipment. All such factors shall be properly investigated and considered in the preparation of the Contractor's proposal. There will be no subsequent financial adjustment for lack of such prior information.

C. The Contractor shall guarantee all equipment and work for one year from the date of substantial completion.

D. Phasing: Work will consist of constructing, retrofitting, and placing in operation all facilities required to complete the improvement project. Phased construction is required to ensure construction that allows operation of the treatment plant in compliance with the facility Groundwater Discharge Permit and National Pollutant Discharge Elimination System (NPDES) permit.

1.03 STANDARD SPECIFICATIONS

The specifications as provided in Appendix B are hereby made a part of this contract and are specifically referenced in other Sections of these specifications.

Where a standard construction method or contract procedure is not specifically covered by the Contract Documents or shown on the plan, the most recent edition of the Michigan Department of Transportation (MDOT) Standard Specifications for Construction shall apply. Specific references made in these documents will be abbreviated as follows: MDOT 000.00.

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Limit use of site and premises to allow Owner access to and operation of all existing treatment facilities.

B. The wastewater treatment plant facilities shall remain operational during the entire project to assure the final effluent limitations of the NPDES permit for the facility are met. Construction shall proceed and Contractor shall coordinate with the Owner such that satisfactory operation of the Wastewater Treatment Plant is maintained.

It is not possible to remove the BioPure Treatment Facility from service during the work. Contractor may coordinate with the Owner to have flows reduced or adjusted in particular areas of the plant to the extent possible.

The Contractor shall not encumber the site with material and equipment that would interfere with operation.

C. Access to Site

1. During construction, all roadways, streets and alleys may not be obstructed unless special permission is received from Owner.

D. Construction Operations: Limited to areas noted on Drawings. Limits of construction shall be confined to property owned by the Owner. Contractor shall coordinate access, site utilization, and work area limits with the Owner.

E. Time Restrictions for Performing Work: Work shall be performed during normal business hours. No night or weekend or Holiday work allowed unless permission is received from the Owner.

F. Utility Outages and Shutdowns: Any utility outages required shall be approved in advance by the Owner. Temporary utilities shall be provided by the Contractor to ensure the full functionality of the facility during temporary outages.

G. The Owner desires to limit tree removals on site during construction of the improvements. Only trees specifically marked “Remove” on the Drawings shall be removed unless specifically authorized by the Owner.

H. Use of Site for Storage and Field Office: Space for storage and field office for the Contractor is the Contractor’s responsibility. Any structures or facilities needed for storage or field office shall be constructed by the Contractor at Contractor’s own expense and no separate payment will be made therefor. The Contractor shall not unreasonably encumber the site with materials and equipment and shall obtain and pay for use of additional storage or work areas needed for operations. The Contractor shall not load structure with weight that will endanger the structure. The Contractor shall move any stored products which interfere with operations of the Owner or other Contractors.

All security requirements for such facilities shall be provided and maintained by the Contractor. The Contractor shall remove any temporary facilities and all surplus materials when there is no

further need of them. Each Subcontractor shall be held responsible to the General Contractor for all damages to existing site facilities disturbed through the performance of his work, or in the delivery of materials or equipment for his use, and shall pay all costs in connection with repairing of same. The General Contractor shall be held responsible that all damage be repaired.

I. During performance of the work, the Contractor shall, at all times, keep the site or sites of the work and adjacent premises as free from material, debris and rubbish as is practical and shall remove it from any portion of the sites, if in the opinion of the Engineer, such material, debris or rubbish constitutes a nuisance or is objectionable.

At the conclusion of the work, all erection plant tools, temporary structures and materials belonging to the Contractor shall be promptly removed from the construction site and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.

The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished and new-appearing condition.

Areas of work shall be clean and dust free prior to beginning operation of new equipment.

1.05 WORK SEQUENCE AND COORDINATION

A. The Contractor shall maintain the Owner's ability to operate its BioPure Treatment Facility at all times during the construction process. Contractor shall provide all temporary pumping, power, etc necessary as a result of work by the Contractor.

B. The Contractor shall be responsible for sequencing construction operations in an efficient manner and to minimize the length of service interruptions. Contractors shall coordinate and cooperate with each other such that the necessary work items and dates can be met.

C. The Contractor may submit a written proposal for changing elements of the sequence of events. Any changes to the sequence of events shall be reviewed and approved by the Owner and Engineer in writing prior to initiation of such by the Contractor.

D. The following is a suggested sequence of the major items of work and is not intended to include every work item:

With the existing aeration basin and biosolids basin in service:

1. Coordinate with Owner to direct clarifier effluent directly to Polishing Pond Pump Station. This requires coordinating with Owner to keep Storage Lagoon 1 and or 2 low to allow for overflow to Storage Lagoon 1 or 2 and/or needs to be done in "low flow" time of year (February through June).

2. Drain existing Polishing Pond pumping to Lagoons 1, 2, and/or 4 with temporary pumps. Coordinate with Owner as to which lagoons to use for discharge. Liquid in polishing pond may contain solids of 1 to 5% in portions of the polishing pond. At Owner's request, Contractor shall pump materials with solids to the existing Biosolids Basin.

3. Complete earthwork to divide Polishing Pond into smaller Polishing Pond and West Biosolids Basin.

4. Concurrent to earthwork, extend waste activated sludge (WAS) forcemain to West Biosolids Basin. Coordinate work with Owner while not wasting activated sludge.

5. Construct Biosolids Pump Station and force main as well as overflow lines and decant chambers. Temporarily plug pipe to south in East Biosolids Decant Chamber.

6. Coordinate with Owner to begin sending WAS to West Biosolids Basin. Install and startup mixer/aerators. At current WAS flow rates of 50 to 100 GPM, it should take approximately 40 days or more before basin is full.

7. Place West Biosolids Basin in service with decant to North Aeration Basin.

8. Construct new outlet to SE corner of Polishing Pond and begin operation of Polishing Pond.

After WAS is directed to West Biosolids Basin in step 7 above:

9. Drain West Biosolids Basin using Contractor supplied temporary pump(s) discharging to the West Biosolids Basin at a rate of 150 gpm or less and coordinate with Owner to allow the Owner's biosolids hauler to remove or discharge solids and water from the East Biosolids Basin to West Biosolids Basin. Contractor shall clean the bottom of the East Biosolids basin and pump any remaining biosolids to the West Bisolids Basin.

10. Remove ex. WAS outlet basins, construct dividing berm in East Biosolids Basin, and construct Biosolids Inlet Structure to East Biosolids Basin and to West Biosolids Basin.

11. Construct piping connecting East Biosolids Basin to East Biosolids Decant Chamber and construct overflow to North Aeration Basin. Install and startup aerators in East Biosolids Basin.

12. Construct yard piping supporting the South Aeration Basin (16-inch Aeration inlet, 24-inch air, 24-inch MLSS outlet).

13. Complete work in South Aeration Basin associated with the aeration system.

14. Coordinate with Owner to lower North Aeration Basin level by directing influent and RAS to the South Aeration Basin and pumping from the North Aeration to South Aeration to complete overflow connections and piping removals and abandonment.

The Headworks Building can be constructed independently of the above. The following shall be completed prior to directing raw wastewater to the Headworks Building:

15. Connect to existing 16-inch force main (will be constructed by others under separate contract) at bypass riser (constructed by others) near northwest corner of North Aeration Basin. Install temporary bypass piping above ground and discharge directly to the North Aeration basin in east third of the north side of the basin.

16. Construct 16-inch force main inlet, bypass, and Raw effluent piping at Headworks Building.

17. Complete dry startup of Headworks equipment and confirm alarm communications to SCADA.

18. Prior to completing Inlet/Splitter box scope of work, remove existing 8-inch 90 degree bend on existing R.A.S. line above grade at south end of Inlet/Splitter box. Rotate bend and reinstall facing aeration basin. Provide temporary piping to route R.A.S. flow to the east third of the aeration basin.

19. Complete Inlet/Splitter Box scope of work.

Work to construct the proposed splitter box to direct flow to the proposed clarifier shall be coordinated with construction of the Headworks Building during bypass of the inlet/splitter box.

20. Tap the existing manhole to install piping to the new splitter box. Install piping from the new splitter box to the location of the new clarifier.

The proposed clarifier, clarifier building, and associated pumps and piping can be installed independently of the remainder of the work. Coordinate construction of the influent line to the clarifier with other activities.

Separately, during low-flow period (approximately March through June), coordinate with Owner to temporarily drain the North Aeration Basin and clean sediments from the basin. Contractor shall be responsible for temporarily removing and reinstalling the air laterals and suspended diffusers. Sediments shall be removed and transferred to a Type II landfill. Contractor shall be responsible for all analytical testing required by the landfill and shall provide copies of load receipts and manifests to the Owner and Engineer. For the purpose of the base bid, Contractor shall assume 2,000 cubic yards of material to remove, haul and dispose. A change order will be negotiated to adjust for the actual quantity.

1.06 PROGRESS SCHEDULE

To enable the work to be laid out and prosecuted in an orderly and expeditious manner, the Contractor shall submit to the Engineer a proposed progress schedule within 20 days after the signing of the Contract. This schedule shall indicate the construction starting date and completion date for each of the various operations to be performed under this Contract. This schedule shall be in the form of a bar chart or of a network diagram showing, in a visual and logical manner, the various work functions or activities necessary to complete the work under this Contract, and the critical relationships between these activities. Activities conducted to ensure operational status of the water treatment plant and the distribution system shall be outlined. Required interruption of service to complete activities under this contract shall be addressed in a manner that includes scope of work, preparation tasks prior to service interruption that will minimize down time, estimate of duration of service interruption, and activities that will be requested of the Owner. The Engineer and the Owner will review the proposed progress schedule to determine conformity to the Contract Documents. If such conformity is demonstrated, the Engineer will accept the proposed schedule.

During the course of the Contract, the Contractor shall submit to the Engineer every 60 days a revised progress schedule indicating any anticipated change from the original progress schedule. The revised schedule shall include provisions for performing work authorized under approved Change Orders. If the Engineer determines that the modifications in the revised progress schedule are reasonable and that they conform to the Contract Documents, the Engineer will accept the revised schedule.

If the Contractor fails to adhere to the approved progress schedule as revised, he shall promptly adopt such other or additional means and methods of construction as will make up for the time lost, and will assure completion in accordance with such schedule.

Once construction has commenced it shall continue through to completion without interruption.

1.07 PERMITS

A. General: The Contractor shall obtain all permits necessary for construction of this project not obtained by the Owner. The Contractor shall pay for any charges or bonds required by agencies for permits, inspections or similar charges to construct this project as shown on the Drawings.

B. Soil Erosion and Sedimentation Control - The Contractor shall submit application and payment and obtain a Soil Erosion and Sedimentation Control permit. Contractor shall meet all requirements of the permit and abide by all applicable rules and regulations as established by the State of Michigan and the local regulating agency in conjunction with Soil Erosion and Sedimentation Control Act (Act 347 P.A. of 1972) as amended. Copies of the state guidelines

"Better Environment through Soil Erosion and Sedimentation Control" may be obtained from the local regulating agency.

C. The Owner will obtain a Part 41 Wastewater Construction Permit from the Michigan Department of Environment, Great Lakes, and Energy. Contractor shall abide by all relevant requirements of this permit, which will be provided when received.

1.08 STAKING, CONTROLS, MONUMENTS

The Owner will provide control stakes for alignment and grade of the proposed project for buildings and pipelines. The Contractor shall preserve these controls and shall furnish additional intermediate controls to assure accurate line and grade. The Contractor may request staking on up to ten (10) separate occasions. Contractor shall be responsible for cost of additional visits or restaking.

The Contractor shall pay for replacement of destroyed controls and benchmarks or monuments.

The Contractor shall exercise proper care in the preservation of all stakes set for their use or the use of the Engineer and if such stakes are damaged, lost or removed by the Contractor's operation, the cost of resetting may be charged to the Contractor. The Contractor shall pay for replacement of destroyed controls and benchmarks or monuments.

Any irregularity in grade and/or line stakes discovered by the Contractor shall be reported to the Engineer for correction before proceeding with the work.

The Contractor shall provide additional methods, materials, or equipment as may be necessary to facilitate laying out, inspecting and constructing the work. The Contractor shall assume full responsibility for all detailed dimensions and elevations measured from the lines, grades and elevations established by the Engineer.

The construction stakes shall be left in place until each phase of the work has been completed and inspected. In the event of discrepancies in the location or grade of the work, the Contractor shall be responsible for making the necessary corrections unless grade stakes are left in place that shows evidence of an error in staking.

1.09 DATUM PLANE

All elevations indicated or specified refer to the NAVD 1988 datum and are expressed in feet and decimal parts thereof, or in feet and inches.

Retrofit activity shall integrate new facilities with existing. Existing facility dimension data was established by field measurement. The Contractor shall field verify actual site conditions.

1.10 BIDDERS RESPONSIBILITY ON UNDERGROUND CONDITIONS

The soil boring logs, as shown on the Drawings, are being furnished to bidders for their convenience and general information only.

Neither the Engineer nor the Owner guarantees the information shown in the boring logs, nor that other materials might not be encountered, nor that the proportions of the various materials shown will not vary from the information shown thereon. The Bidder will be responsible for making his own sub-surface soil investigations and shall make his own determinations therefrom.

The Bidder hereby waives all claims for damages which he may suffer by reason of the inadequacies or discrepancies of the information shown on these soil boring logs and understands that no compensation will be paid to him due to any inadequacy or discrepancy in this data.

1.11 ALLOWANCE – RELOCATION OF EXISTING UTILITIES

As required by these specifications, Contractor shall be solely responsible for locating and protecting all existing utilities on site during the work and no additional payment will be made for these activities. However, it is anticipated that there will be a need for 1 to 2 days of work to relocate existing utilities. This will include only situations where the Contractor, Owner, and Engineer agree that the location of an existing utility as discovered by the work creates a conflict and necessitates removal and relocation of the existing utility that is not already shown in the Drawings. If the Contractor proceeds with relocation without written authorization from the Owner, no payment will be made for the work. Payment for authorized relocation work shall be made by Allowance. Allowance for this work shall be $10,000. See Section 01 21 00 – "Allowances" for further detail.

1.12 PROTECTION OF EXISTING UTILITIES

A. The Contractor must comply with Act 174 of 2013, as amended, MCL 460.721 et seq., and all other Laws concerning Underground Utilities. Before performing site Work, all Underground Utilities, lines and cables both public and private must be located and marked. The Contractor shall notify MISS DIG to locate and mark utilities. The Contractor shall be responsible for locating and marking all utilities not otherwise located through the MISS DIG system including private utilities.

B. Various underground and overhead structures and utilities are shown on the Drawings. The location and dimensions of such structures and utilities, where given, are believed to be reasonably correct, but do not purport to be absolutely so. These structures and utilities are plotted on the Drawings for the information of the Bidders, but information so given is not to be construed as a representation or assurance that such structures will be found or encountered as plotted, or that such information is complete or accurate. Bidders, therefore, shall satisfy themselves by such means as they may deem proper as to the location of all structures and utilities that may be encountered in the construction of the work. Specific utility locations and elevations, where shown on the Drawings, shall be field verified by the Contractor prior to the start of construction.

C. The Contractor shall notify the utility companies of his schedule and obtain any necessary permits from them.

D. The Contractor shall pay for any charges by the utility companies for permits, inspections, or similar charges required to construct the project as shown on the Drawings.

E. In addition, the Contractor shall immediately notify the Owner of any contact with or damage to Underground Utilities. Contractor shall be solely responsible for the safety, protection of, and repairing any damage done to any Work, surface and subsurface structures and utilities at no additional cost.

1.13 PROTECTION OF NATURAL RESOURCES

A. The Contractor shall take all necessary steps to prevent damage to fish and game habitat and to preserve the natural resources of the State. Construction shall be carried out so as to minimize discharge of damaging material into any stream, lake, or reservoir.

B. The Contractor shall exercise caution in the discharge of waters from pumps, deep wells, or well point systems, in order that such discharges do not cause erosion, siltation, soil depositions, etc., in sewers, streams or other water courses or drainage structures.

C. The Contractor shall not permit any sand or debris of any kind to enter the existing ditches, streams, storm sewers or culverts.

D. The rules and regulations of all work shall comply with Part 31 (Water Resources Protection), Part 301 (Inland Lakes and Streams Act), Part 91 (Soil Erosion), and Part 303 (Wetland Protection) of P.A. No. 451 (Natural Resources and Environmental Protections Act of 1994).

1.14 U.S. FISH AND WILDLIFE SERVICE

If any identified endangered or threatened species and associated habitat are observed within the project area during construction, demolition, or earthmoving activities, or if the scope of work changes in any way that may impact identified species, the Contractor shall immediately stop work and the recipient will notify EDA and the Michigan Department of Environment, Great Lakes, and Energy. Refer to the U.S.F.W.S correspondence provided in Appendix C. Contractor shall follow all guidance as outlined in the U.S.F.W.S correspondence letter.

1.15 HISTORIC OR ARCHEOLOGICAL ARTIFACTS

If historic or archeological artifacts or remains discovered during construction, the Contractor must cease work and notify the Owner and Engineer immediately. No work in the vicinity of the artifacts may commence until state historic preservation office has determined the general limits and potential significance of the site. If human remains are discovered during the construction, the contractor must immediately contact the police department, owner, and engineer.

1.16 PROTECTION OF ADJACENT STRUCTURES AND LANDSCAPING

The Contractor shall be entirely responsible for all damage to water pipes, electric conduits or cables, drains, sewers, gas mains, poles, telephone and telegraph lines, railroad bridges and tracks, streets, pavements, sidewalks, curbs, fences, street and highway bridges and culverts, building foundations, retaining walls or other structures of any kind met with during the progress of the work, and shall be liable for damages to public or private property resulting therefrom.

The cost of protection, replacement in their original positions and conditions or payment for damages thereto of pipe lines and structures affected by the work and the removal, relocation and rebuilding of pipe lines and structures called for on the Drawings or specified shall be deemed included in the contract lump sum. No additional payment will be made therefor.

The Contractor shall, at all times in performance of the work, employ approved methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of public utility installations and structures; and shall, at all times in the performance of the work, avoid unnecessary interference with, or interruption of, public utility services, and shall cooperate fully with the Owner and utility owners thereof to that end.

All pipe lines carrying liquid shall be adequately protected from freezing. All fire hydrants, valves and appurtenances on the various water systems shall be maintained in service, and temporary connections shall be provided where necessary.

Beneath trees or other surface structures, where possible, pipelines may be built in short tunnels, backfilled with excavated materials, except as otherwise specified, or the trees or structures carefully supported and protected from damage.

Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the start of work. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the Engineer. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or Items, or if no specific Item is provided therefor, as part of the overhead cost of the work, and no additional payment will be made therefore.

1.17 ALLOWANCES

See Section 01 21 00 Allowances for further detail.

1.18 WARRANTY

The Contractor shall warranty and guarantee all equipment and work for a minimum of one year from the dates of substantial completion. Greater warranty duration may be required by the project specifications for specific equipment and/or work.

1.19 SAFETY

The Contractor is solely responsible for safety in accordance with the General Conditions.

PART 2 - PRODUCTS
*** Not Used ***

PART 3 - EXECUTION
*** Not Used ***

END OF SECTION

[Intentionally left blank]

SECTION 01 21 00
ALLOWANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Administrative and procedural requirements governing handling and processing of Allowances.

1.02 ALLOWANCES

A. It is intended that the work covered by these Cash Allowances will be done within this Contract under the supervision of the General Contractor and/or Subcontractors. All outside expenses, overhead and profit connected with the work contemplated in these Allowances shall be included in the Contract Base Bid Price. If actual work covered by an allowance differs in cost from the allowance, a Change Order shall be processed to adjust for the difference. No mark-up for the General Contractor or Subcontractors shall be included in such Change Order.

1.03 SELECTION AND PURCHASE

A. At the earliest feasible date after Contract award, advise the Engineer of the date when the final selection and purchase of each product or system described by an Allowance must be completed in order to avoid delay in performance of the work.

B. When requested by the Engineer, obtain proposals for each Allowance for use in making final selections; include recommendations that are relevant to performance of the work.

C. Purchase products and systems as selected by the Engineer from designated supplier.

1.04 SUBMITTALS

A. Submit under the provisions of Section 01 33 00 – “Submittals.”

B. Proposals for installation and purchase of products or systems included in Allowances.

C. Invoices or delivery slips to indicate actual costs and quantities of materials delivered to the site for use in fulfillment of each allowance.

1.05 UNUSED MATERIALS

A. Return unused materials to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.

B. Where it is not economically feasible to return unused material for credit and when requested by the Engineer, prepare unused material for the Owner's storage, and deliver to the Owner's storage space as directed. Otherwise, disposal of excess material is the Contractor’s responsibility.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect products covered by an Allowance promptly upon delivery for damage or defects.

3.02 PREPARATION

A. Coordinate materials and their installation for each Allowance with related materials and installations to ensure that each Allowance item is completely integrated and interfaced with related construction activities.

3.03 LIST OF ALLOWANCES

A. Relocation of Existing Utilities – See Section 01 10 00

B. Signs and Identifying Devices – See Section 10 14 00

C. Natural Gas Service Modifications – See Section 23 05 00

D. Overhead Electric Relocation – See Section 26 05 00

E. RIBs Electric Utility Allowance – See Section 26 05 00

F. Unexpected Underground Conflicts Allowance – See Section 31 23 00

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.01 GENERAL: Project meetings for coordination of Contractor activity with the operation of the wastewater treatment plant will be held as detailed in this section with additional meetings as requested by the Owner or Engineer, as dependent on the staging requirements for specific portions of the project. Meetings will be held at a location chosen by the Owner.

1.02 PRE-CONSTRUCTION MEETING

A. Schedule: Meeting shall be prior to the start of work at a time and place designated by the Engineer. Contractor shall be required to attend with major Subcontractors.

1.03 PROGRESS MEETINGS

A. Schedule: Meetings will be scheduled once every two to four weeks at place designated by the Engineer. Contractor shall attend all progress meetings and shall have Subcontractors attend as relevant to the current status of the project.

PART 2 - PRODUCTS

*** Not Applicable ***

PART 3 - EXECUTION

*** Not Applicable ***

END OF SECTION

[Intentionally left blank]

SECTION 01 33 00
SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Data to be furnished by the Contractor.

1.02 CONSTRUCTION PROGRESS SCHEDULE

A. See requirements for Contractor submission of a construction progress schedule in Section 01 10 00 – "Summary of Work."

1.03 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. General: Where required by the Specifications, the Contractor shall submit descriptive information which will enable the Engineer to advise the Owner whether the Contractor's proposed materials, equipment, or methods of work are in general conformance to the design concept and in compliance with the Drawings and Specifications. The information to be submitted shall consist of drawings, specifications, descriptive data, certificates, samples, test results and such other information, all as specifically required in the Specifications. Shop drawings shall be in accordance with the General Conditions and Supplementary Conditions and the requirements outlined herein.

B. Submittal Content and Format: Submittals shall be numbered consecutively and distinctly present the following:

1. All working and erection dimensions.
2. Arrangements and sectional views.
3. Necessary details, including complete information for making connections between work under this Contract and work under other Contracts.
4. Electrical wiring connections between all equipment furnished under the Contract, including all internal wiring between internal components of equipment and controls.
5. Kinds of materials and finishes.
6. Parts lists and description thereof.
7. Drawings for mechanical and electrical equipment shall present, where applicable, such data as dimensions, weight, and performance characteristics. These data shall show conformance with the performance characteristics and other criteria incorporated in the Contract Documents.

C. Contractor Responsibility

1. Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that the material and equipment described in each submittal conform to the requirements of the Specifications and Drawings. If the information shows deviations from the Specifications or Drawings, the Contractor shall insure that there is no conflict with other submittals and notify the Engineer in each case where submittal may affect the work of another Contractor or the Owner. The Contractor shall insure coordination of submittals among the related crafts and Subcontractors.
2. The Contractor shall be responsible to check and verify all field measurements, all dimensions on shop and setting drawings and all schedules required for the work of all the various trades.
3. The Contractor may authorize in writing a material or equipment supplier to deal directly with the Engineer or with the Owner with regard to a submittal. These dealings shall be limited to contract interpretations.

4. The Contractor shall stamp each submittal with stamp, initialed and signed, certifying to review of the submittal by the Contractor, verification of field measurements and compliance with Contract Documents.

D. Transmittal Procedure

1. Submittals shall be submitted promptly in accordance with dates in proposals, approved schedules and in such sequence that there is no delay in the Work or the work of any other Contractor. Submittals may be submitted by mail or electronically per the requirements listed below.
2. Submittals regarding material and equipment shall be accompanied by clear identification of the equipment and any variations from these Specifications.
3. A unique number, sequentially arranged, shall be noted on the transmittal form accompanying each item's submittal. Original submittal numbers shall have the following format "XXX-Y:; where "XXX is the originally assigned submittal number, and "Y" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd and 3rd resubmittals, respectively. Submittal 025-B, for example, is the second resubmittal of submittal 25.

E. Electronic Transmittal Procedure – Submittals shall be submitted electronically via the Prein&Newhof Plan Room in accordance with the above “Transmittal Procedure” requirements as well as the following requirements and procedures.

1. Contractor shall be given a Login ID and Password to the Prein&Newhof Plan room. The website for the Prein&Newhof Plan Room is http://www.preinnewhof.com/plan-room/.
2. Upon logging into the website, the Contractor will have access to a project folder labeled with the name of the Owner and Project. This folder will only be accessible to the Contractor, the Owner, and the Engineer.
3. Login and password will not be provided to Subcontractors. If the Contractor provides their login information to their Subcontractors, the Contractor assumes responsibility for the Subcontractor’s actions.
4. The Contractor may request automatic notifications by email of an “Upload” of both submitted and reviewed documents.
5. Within the “Project Folder” there will be a “To Be Reviewed” folder and a “Reviewed” Folder. Contractor shall upload submittals in PDF format to the “To Be Reviewed” subfolder. The time and date of the upload will be logged and automatic email notifications will be sent.
6. All submittals shall be prepared in accordance with this Section 01 33 00 of the specifications. Electronic submittals shall have the following naming format:

   Submittal Number – Specification Section – Description.pdf

   For example –001-033000-Concrete Mix Design.pdf

   A letter shall be added after the submittal number for resubmittals. For example, 001B-033000-Concrete Mix Design.pdf would be the second resubmission.
7. Within 15 days, reviewed submittals will be posted in the “Reviewed” folder. Automatic email notifications of the upload will be sent.
8. The Engineer will update the “Shop Drawing Status Log” and post it in the Project Folder as submittals are received, where it will be accessible by the Owner, Contractor, and Engineer.
9. Contractor shall submit any submittal requiring an Engineer’s seal as a hard copy. In addition, all submittals with an original size greater than 11 inches by 17 inches shall be submitted as a hard copy. All hard copy submittals shall also be submitted electronically.

F. Deviation from Contract: If the Contractor proposes to provide material or equipment which does not conform to the Specifications and Drawings, he shall indicate so under "deviations" on the transmittal form accompanying the submittal copies. Contractor shall prepare reason for a change, including cost differential, and request a change order to cover the deviations.

G. Submittal Completeness: Submittals which do not have all the information required to be submitted, including deviations, are not acceptable and will be returned without review.

H. Review Procedure

1. When the contract documents require a submittal, the Contractor shall submit five (5) copies of all submittal data (or one (1) electronic copy if submitting electronically), of which two (2) copies will be retained by the Engineer. For samples this number may vary. For samples, submit the number stated in each Specifications Section.
2. If the review indicates that the material, equipment or work method is in general conformance with the design concept and complies with the Drawings and Specifications, submittal copies will be marked "NO EXCEPTIONS TAKEN". In this event the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
3. If the review indicates limited corrections are required, submitted copies will be marked "FURNISH AS CORRECTED". The Contractor may begin implementing the work method by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in Operation and Maintenance data, a corrected copy shall be provided.
4. If the review reveals that the submittal is insufficient or contains incorrect data, submitted copies will be marked "REVISE AND RESUBMIT". Except at its own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "FURNISH AS CORRECTED".
5. If the review indicates that the material, equipment or work method is not in general conformance with the Drawings and Specifications, copies of the submittal will be marked "REJECTED". Submittals with deviations which have not been identified clearly may be rejected. Except at its own risk the Contractor shall not undertake the work covered by such submittals until it has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "FURNISH AS CORRECTED".
6. If the review indicates that the material or equipment is not from an acceptable manufacturer, as indicated in the Specifications, copies of the submittal will be marked "REJECTED". Except at its own risk, the Contractor shall not undertake the work covered by such submittals until it has been revised, resubmitted and returned marked either “NO EXCEPTIONS TAKEN" or "FURNISH AS CORRECTED".
7. If the review indicates “ACKNOWLEDGED RECEIPT”, the submittal under review has been appropriately noted and filed. No further action is required for a submittal so noted.
8. If the review indicates “ON HOLD”, the submittal is being held in the office of the Engineer pending the submittal of additional information, etc. so that the review can be completed. No further action on the submittal shall be taken until the information needed has been received and the submittal is returned marked either "NO EXCEPTIONS TAKEN" or "FURNISH AS CORRECTED".

I. Effect of Review of Contractor's Submittal

1. Review of Drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of its responsibility for errors therein and shall not be regarded as an assumption of risks or liabilities by the Engineer or the Owner, or by an officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed.
2. Review of Drawings also shall not relieve the Contractor of responsibility for the proper fitting and construction of the work nor for the furnishing of materials or work required by the Contract and not indicated on the Drawings.
3. A mark of "NO EXCEPTIONS TAKEN" or "FURNISH AS CORRECTED" shall mean that the Owner has no objection to the Contractor, upon its own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.

1.04 LIST OF SHOP DRAWING SUBMITTALS

A. Requirements

1. Within two (2) weeks after Notice of Award, the Contractor shall submit for review by the Engineer an anticipated list of shop drawing submittals and submittal dates.

1.05 OPERATION AND MAINTENANCE DATA

A. Requirements

1. Compile product data for all equipment and associated controls systems furnished and installed under this Contract. Provide all necessary information for Owner's operation and maintenance of products furnished.
2. Prepare data in the form of an instructional manual for use by Owner's personnel. Prepare three (3) copies or complete sets compiled, bound in hard stock, and indexed.
3. A USB drive shall be provided of the entire manual in electronic, PDF, format.
4. The manuals shall include detailed operation and maintenance instructions for all equipment, the name and phone number of the manufacturer, and a complete parts list.
5. Submittal of operation and maintenance manuals shall be prior to final payment request.
6. Each hard copy of the manual shall be prepared and arranged as follows:
    a. One hard copy of all approved shop drawings and diagrams for all equipment furnished. If the Contractor originally submitted the shop drawings electronically, a hard copy of each shall be printed and provided by the Contractor in each O&M manual. All sheets larger than 8-1/2 by 11 inches shall be folded to 8-1/2 by 11 inches.
    b. One copy of each manufacturer's operation, lubrication, maintenance instructions and spare parts list for all equipment and controls furnished. All equipment operating, lubrication and maintenance instructions and procedures and parts lists shall be furnished on 8-1/2 by 11 inch commercially printed typed forms. Such forms shall include equipment name, serial number and other identifying references.
    c. One valve schedule, giving the valve number, location, fluid and fluid destination for each valve installed, prepared on 8-1/2 by 11 inch printed or typed forms as specified. All valves in the same piping system shall be grouped together in the schedule. A sample of the valve numbering system to be used will be furnished by the Engineer.
    d. List of electrical relay settings and control and alarm contact settings.
    e. Electrical interconnection wiring diagram for equipment furnished including all control and lighting systems.
    f. Each copy of the manual shall be assembled in one or more binders , each with title page, typed table of contents, and heavy section dividers with copper reinforced holes and numbered plastic index tabs. Each manual shall be divided into sections paralleling the Special Specifications equipment specifications. Binders shall be 3-ring, hard-back type. All data shall be punched for binding and composition and printing shall be arranged so that punching does not obliterate any data. The cover and binding edge of each manual shall have the project title, and manual title printed thereon, all as approved by Engineer.
    g. Where more than one binder is required they shall be labeled Vol. 1, Vol. 2, and so on. The table of contents for the entire set, identified by volume number, shall appear in each binder.
7. When the work reaches 80 percent completion, the Contractor shall submit to the Engineer two copies of the Operation and Maintenance Manual with all specified material that is available at that time. The submittal shall accompany the Contractor's partial payment request for the specified completion. Within 30 days after the Engineer's approval of the two-copy submittal, the Contractor shall furnish to the Engineer the remaining copies of the manual. Appropriate space shall be left in the manual for material non available at the time of the initial submittal. Manual shall be complete prior to request for final payment.

The costs of the Operation and Maintenance Manual shall be included in the Contract Price and no separate payment will be made therefore.

1.06 RECORD DOCUMENTS

A. Requirements

1. The Contractor shall maintain on the construction site a minimum of one (1) complete set of contract documents amended by "RED LINE" or highlight inclusion to reflect the most immediate status methods, materials, and locations and routings of construction. Supplementary sketches shall be included, if necessary, to clearly indicate all work as constructed.
2. At conclusion of work, the Contractor shall submit to the (Engineer) one (1) complete amended record set of these site documents.
3. Submittal shall be prior to final payment.
4. Failure of the Contractor to maintain an up-to-date set of Record Drawings on the project site shall be reason to withhold payments.

PART 2 - PRODUCTS
*** Not Used ***

PART 3 - EXECUTION
*** Not Used ***

END OF SECTION

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SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 GENERAL

A. This section covers provision of temporary utilities by the Contractor or Owner during the Work.

1.02 TEMPORARY SERVICES

A. Temporary Heat: The Contractor shall provide temporary heat as soon as possible inside buildings for use in furnishing and protecting the interior. The Contractor shall provide the heating apparatus, fuel, labor and other incidental items to provide this temporary heat. The Contractor may use the building's heating system once it is installed.

Except as otherwise called for, a minimum temperature of 50°F and a maximum temperature of 75°F in the building shall be maintained during working hours. At other times the temperature in the building shall be kept above freezing.

See requirements for detailed specifications for minimum temperature to be maintained for the application of work under the various trades.

B. Temporary Power: Within the limits of the available power supply from the existing service, the Owner will furnish necessary electricity to the Contractor without charge, providing the Contractor takes reasonable means to conserve it. Distribution of the electricity is the Contractor's responsibility.

C. The Electrical Subcontractor shall be responsible for, and include in his bid price, the cost of: wiring for lighting and power outlets in areas where lighting and power source is not ample as determined by the General Contractor or Engineer; temporary connections for motors, pumps, burners, etc. at the direction of the Engineer where heating, ventilation, or other equipment testing is required during construction; and removal of all temporary service items at the end of the project.

D. Temporary Water: Within the limits of the available water supply from the existing service, the Owner will furnish necessary water to the Contractor without charge, provided the Contractor coordinates use with the Owner and takes reasonable means to conserve it. The Contractor shall be responsible for the distribution of the water.

E. Temporary Sanitary Facilities: The General Contractor shall provide temporary facilities for use of all workers on the project. Maintain in clean, sanitary condition and remove same, and all contents upon completion of the work.

F. Temporary Internet Service: There is no internet service available for Contractor use on the site. If the Contractor desires to have internet service for himself and/or Subcontractor it shall be the responsibility of the Contractor to obtain and pay for internet service. If internet service is obtained by the Contractor, Contractor shall provide internet access to the Owner and Engineer upon request.

PART 2 - PART 2 - PRODUCTS
*** Not Used ***

PART 3 - PART 3 - EXECUTION
*** Not Used ***

END OF SECTION

[Intentionally left blank]

SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the work required to provide and maintain temporary soil erosion and sedimentation control.

1.02 JOB CONDITIONS

A. Scheduling: Clean-up shall occur within one week after erosion control measures are no longer required.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Operational Data: Contractor shall submit a plan for the control of soil erosion and sedimentation to the local agency regulating soil erosion and sedimentation. Plan shall comply with the Soil Erosion and Sedimentation Control permit obtained by the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials used for temporary erosion and sedimentation control shall be approved by the regulating agency.

PART 3 - EXECUTION

3.01 PERFORMANCE

A. General: Abide with all applicable rules and regulations as established by the State of Michigan and the local regulating agency in conjunction with Part 91 Soil Erosion and Sedimentation Control of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Copies of the state guidelines "Better Environment through Soil Erosion and Sedimentation Control" may be obtained from the local regulating agency.

B. Sediment Removal: Take such steps as are necessary to assure the retention and removal of any sediment which enters a drainage system along the construction route before said system discharges into a stream, pond, or lake.

C. Soil Erosion and Sedimentation Control Measures: Contractor shall obtain a Soil Erosion and Sedimentation Control Permit from the regulating agency. Furnish, install and maintain soil erosion and sedimentation control measures in accordance with the Soil Erosion and Sedimentation Control Permit and any additional measures as needed to prevent any sediment from entering surface water.

1. Maintain controls during non-working hours and during working hours if weather so requires.
2. Remove silt or solids retention at control structures following construction.
3. Contractor shall be responsible for the degree of control required, subject to the Permit requirements.

END OF SECTION

[Intentionally left blank]

PART 1 - GENERAL

1.01 MATERIALS AND EQUIPMENT:

A. Materials and equipment incorporated into the Work:

1. Shall conform to applicable specifications and standards.
2. Shall comply with size, make, type and quality specified or as specifically approved by the Engineer.
3. Manufactured and Fabricated Products.
    a. Design, fabricate and assemble in accord with the best engineering and shop practices.
    b. Manufacture like parts of duplicate units to standard sizes and gages to be interchangeable.
    c. Two or more items of the same kind shall be identical, by the same manufacturer.
    d. Products shall be suitable for service conditions.
    e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
4. Do not use material or equipment for any purpose other than that for which it is designed or specified.

1.02 MANUFACTURER'S INSTRUCTIONS:

A. When Contract Documents, require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two sets to the Engineer.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.

B. Handle, install, connect, clean, and condition and adjust products in strict accord with such instructions and in conformity with specified requirements.

C. Perform work in accord with manufacturer's instructions. Do not omit any preparatory step or installation procedures unless specifically modified or exempted by Contract Documents.

1.03 TRANSPORTATION AND HANDLING:

A. Arrange deliveries of products in accord with construction schedules; coordinate to avoid conflict with work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging with identifying labels intact and legible.
2. Immediately upon delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.04 STORAGE AND PROTECTION:

A. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.

1. Store products subject to damage by the elements in weather tight enclosures.

2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

B. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections to assure that products are maintained under specified conditions and free from damage or deterioration.

1.05 SUBSTITUTIONS/ALTERNATE EQUIPMENT:

A. Where materials and equipment items are identified in the Drawings or specifications by manufacturer's name or catalog number, bids shall be based on the products of one of the manufacturers so named or added thereto by addendum during the bidding period. An add/deduct price may also be provided for alternate equipment as shown on the Bid Proposal. All cost associated with utilizing equipment provided by other Manufacturers shall be included in the add or deduct including all building, electrical, mechanical or any other changes necessary to install the equipment. In addition, Contractor shall be responsible for reimbursing Owner for all engineering and design related to contract modifications necessary to utilize alternate equipment.

B. Documentation for alternate equipment must be provided as detailed in this section. Review of documentation will be completed by the Engineer and Owner after the bid.

C. Required documentation for substitutions/alternate equipment must be received by the Engineer not later than 24 hours after the bids are received. This information will be required from each bidder who submitted one of the three lowest base bids.

D. A request for a substitution/proposed alternate equipment constitutes a representation that the Contractor has investigated and determined the proposed product is equal to, or superior in all respects to that specified.

E. The Contractor shall coordinate the installation of an accepted substitution into the Work and make the Work complete in all respects.

F. The Engineer shall be the judge of the acceptability of the proposed substitutions.

G. Requests for substitutions shall be submitted on the accompanying form. In addition to the form, supporting documentation shall be submitted providing technical details of the equipment for this application including complete equipment drawings and scope of supply, review of the specifications including any proposed deviations from it, manufacturer’s company history, financial ability of the manufacturer, similar installations of the proposed equipment with reference information including dates of service and contact phone numbers, and any other information deemed necessary by the Engineer for a thorough review. Contractor shall include a complete and detailed list describing all deviations where proposed equipment differs from this specification.

PART 2 - PRODUCTS
*** Not Applicable ***

PART 3 - EXECUTION
*** Not Applicable ***

APPLICATION FOR APPROVAL OF SUBSTITUTE MATERIAL/EQUIPMENT

Material/Equipment	Manufacturer	Model No. Certificate No. or Other Description

Proposed Substitute Material/Equipment:

Material/Equipment	Manufacturer	Model No. Certificate No.

Approval of Substitution _____ Contractor _____ Date

Not Approved _____ Engineer _____ Date

END OF SECTION

[Intentionally left blank]

SECTION 01 75 00
STARTING AND ADJUSTING

PART 1 - GENERAL

1.01 GENERAL

A. Prior to Substantial Completion, Contractor shall conduct startup and adjustment of all portions of the work to provide a fully functional wastewater treatment plant. All equipment provided shall be subject to the requirements of this section and further requirements in each section where specific equipment is specified.

PART 2 - PRODUCTS

*** Not Used ***

PART 3 - EXECUTION

3.01 GENERAL

Due to the sequencing required to maintain operation of the wastewater treatment plant during construction, specified startup activities for equipment shall be required each time an individual unit is placed in operation. Training of the Owner for a specific type of equipment shall only be required once.

3.02 MANUFACTURER'S SERVICE ENGINEER

Contractor shall furnish the services of a competent Manufacturer's Service Engineer, if necessary during construction. A Manufacturer's Service Engineer shall be on the site at the time of initial operation of the manufacturer's equipment and must approve the installation before it is placed into service.

3.03 PERFORMANCE TEST AND TRIAL OPERATION

Performance tests of the new facilities will be required and will be made in the presence of the Owner, Contractor, and Engineer. All areas where work has been performed shall be thoroughly cleaned before beginning any performance tests. Operating personnel and power will be provided by the Owner. If any part of the equipment does not meet specifications, the Contractor shall correct the situation to the approval of the Engineer. The Contractor shall provide personnel and bear all costs of correcting any malfunctions in the work under this Contract.

A two week trial operation period shall be conducted for each system component. Training of wastewater treatment plant personnel shall be conducted as requested by the Owner during the performance test and trial operation period. The performance test will be considered complete when the Contractor has corrected any malfunctions in the work and the Owner indicates the test has been completed to his satisfaction. Equipment testing and performance testing shall be conducted as construction proceeds.

END OF SECTION

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EXISTING CONDITIONS

DIVISION 2

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SECTION 02 22 13
MOVEMENT AND VIBRATION ASSESSMENT AND MONITORING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Vibration producing activities (such as pile driving, vibratory compaction, or operation of heavy construction equipment) will be required for construction of this project.

B. The Contractor is advised that structures are located close to the proposed work and that construction activities shall be conducted to preclude damage to same. The Contractor shall be responsible for any damage caused by their activities.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. At least 30 days prior to start of such work, the Contractor shall provide a construction sequencing and equipment plan to the Engineer, which shall include, but not be limited to the following: proposed construction method(s), proposed equipment, vibration monitoring plans, anticipated vibration levels at the specified building(s), and condition survey format.

PART 2 - PRODUCTS

*** Not Applicable ***

PART 3 - EXECUTION

3.01 CONDITION SURVEY

A. A preconstruction building condition survey shall be conducted by the Contractor at the south half of the Treatment Building.

B. The survey shall include documentation of interior sub-grade and above grade accessible walls, ceilings, floors, roof and visible exterior as viewed from the grade level. It shall detail (by engineering sketches, video, photographs, and/or notes) any existing structural, cosmetic, plumbing or electrical damage. The survey shall be conducted by a Professional Engineer, registered in the State of Michigan.

C. A report shall be issued that shall summarize the pre-construction condition of the building(s)/structure(s) and shall identify areas of concern, including potential personnel hazards (falling debris) and structural elements that may require support or repair.

D. Crack displacement monitoring gauges shall be installed as appropriate across any significant existing cracks to help verify any additional structural distress if it should develop. The appropriate location, number, and type of gauges shall be established by the Contractor and/or the Project Engineer. The gauges shall be read prior to vibration producing activities, as well as during these activities. Data shall be obtained on a weekly basis for as long as vibration-producing activities are being conducted. A report shall be submitted which summarizes the data. The Engineer shall be alerted if any significant movement is detected by the monitoring gauges.

3.02 MONITORING

A. The Contractor shall employ a qualified vibration specialist to establish a safe vibration level for the structures. This specialist shall also supervise the Contractors vibration-monitoring program. During all vibration producing activities, the Contractor shall monitor vibration levels at the specified structures, and the vibrations shall not exceed the safe level established to preclude damage to the identified structures.

B. The vibration monitoring equipment shall be capable of continuously recording the peak particle velocity and providing a permanent record of the entire vibration event. Copies of all vibration records and associated construction activity (pile driving, etc.) data shall be provided to the Engineer in a format approved by the Engineer.

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. The work covered by this section consists of furnishing all supervision, labor, materials, and equipment necessary to demolish all specified structures, surface improvements, and underground utilities shown in the Drawings, and to remove debris from the site in accordance with all federal, state and local regulations.

B. This Section requires demolition and abandonment of site piping, and demolition, removal and off-site disposal of building and treatment unit materials, as shown in the Drawings.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Contractor shall propose a schedule of operations including coordination for shutoff, capping, and continuation of utility services as required.

1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's operations.

1.03 JOB CONDITIONS

A. The bidder shall be responsible for inspecting the site of the proposed work and to determine for himself all conditions under which he will be obligated to work. It is also expected that the bidder will obtain firsthand information concerning the available facilities for receiving, transporting, disposing, handling and storing demolished equipment and materials, and concerning other local conditions that may affect the work.

B. Existing Plans: Available plans from two previous construction activities issued in 1989 and 2000 are available for reference in the Prein&Newhof Plan Room (http://www.preinnewhof.com/plan-room/). These plans are for general information purposes only and are not guaranteed to represent current or as constructed conditions.

C. Occupancy: Structures to be demolished will be vacated and use discontinued prior to start of work.

D. Condition of Structures: Owner assumes no responsibility for actual condition of structures to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner insofar as practicable. However, variations within structure may occur due to Owner's removal and salvage operations prior to start of demolition work.

2. The Contractor is responsible to perform site investigation as required to determine the actual amount of work required to achieve the requirements of this specifications.

E. Salvaged Materials: Items of salvable value to Contractor not designated to be turned over to the Owner may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

1. Storage or sale of removed items will not be permitted on site.

F. Explosives: Use of explosives will not be permitted.

G. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

H. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent damage to adjacent buildings, structures, and other facilities and injury to persons.

1. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structures to be demolished and adjacent facilities to remain.

I. Damages: Promptly repair damages caused to adjacent facilities by demolition operations.

J. Utility Services: Maintain existing utilities indicated to stay in service and protect against damage during demolition operations.

1. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

K. Utility Services: Do not start demolition work until utility disconnections have been completed and verified in writing.

L. Comply with requirements of NFPA 241, “Safeguarding Construction, Alteration, and Demolition Operations.”

M. Lead, Asbestos, and other Hazardous Substances: Demolition work shall comply with all federal, state, and local agency requirements with respect to identification and hazard control of lead, asbestos, and other hazardous substances. Provide trained personnel as required by these agencies. The Contractor is responsible to obtain all required permit(s) for demolition, transport, and disposal of debris from federal, state and local authorities when required by them.

N. Demolition includes all work necessary for proper removal and disposal of fluorescent tubes and ballasts and mercury switches, and removal and proper disposal of reinforced concrete, steel, piping, equipment, electrical facilities, and any other materials or equipment shown or specified to be removed. As part of this contract, it shall be the Contractor’s responsibility to characterize, remove and properly dispose of these items in accordance with all applicable laws and regulations.

O. Coordination with Wastewater Plant Operation: The Owner will accommodate, to the extent possible, interruption of wastewater treatment plant operation for limited amounts of time. Demolition work shall be conducted in such a manner as to minimize these interruptions. Work shall also be conducted in such a manner as to avoid hazards to persons and property. Contractor shall erect barriers, fences, guard rails, enclosures, and shoring to protect personnel, structures, and utilities remaining intact.

P. Mechanical and Electrical trades shall remove equipment, piping, conduit, and other items pertaining to their respective trades. This shall include temporary removal and reinstallation where necessary.

PART 2 - PRODUCTS

*** Not Used ***

PART 3 - EXECUTION

3.01 DEMOLITION

A. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air. Comply with governing regulations pertaining to environmental protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

2. All work where applicable shall conform to the State of Michigan Soil Erosion and Sedimentation Part 91, Act 451 of the Public Acts of 1994, as amended and related ordinances.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

C. Filling Voids: Completely fill below-grade areas and voids resulting from demolition of structures.

1. No demolition debris may be placed in below-grade areas or voids resulting from demolition of structures.

2. Use granular MDOT Class II fill.

3. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash, and debris.

4. Place fill materials in horizontal layers not exceeding 12 inches in loose depth. Compact each layer at optimum moisture content of fill material to density equal to original adjacent ground, but not less than 95 percent density when tested in accordance with ASTM D1556.

5. After fill placement and compaction, grade surface according to the proposed contours on the Drawings and place topsoil and grass seed.

D. Buried Pipes: Buried pipes permanently removed from service shall be completely removed unless specifically noted otherwise.

E. Care shall be taken to assure that demolition activity does not damage other facilities. Contractor shall make good, without additional cost to the Owner, work damaged by demolition activity.

3.02 OTHER MATERIALS

Contractor shall remove and properly handle all fluorescent tubes, PCB-containing light ballasts, and any mercury switches. As part of this contract, it shall be the Contractor's responsibility to characterize, remove and properly dispose of these items in accordance with all applicable laws and regulations.

3.03 SALVAGED MATERIALS

A. General: Remove carefully to avoid damages. Materials for reuse on this project (if any) are to be incorporated into new work if indicated.

1. Salvage the following items for reuse/relocation by the Contractor:

a. Automatic sampler for raw wastewater influent.

b. Submersible pumps in existing polishing pond pump station.

Contractor shall verify that all items the Owner wishes to keep have been removed before beginning demolition.

2. Except for items indicated to be retained as Owner's property, other removed and salvaged materials not indicated for reuse shall become Contractor's property and removed from site with further disposition at Contractor's option.

3.04 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove weekly from site accumulated debris, rubbish, and other materials resulting from demolition operations.

1. Burning of combustible materials from demolished structures will not be permitted on site.

B. Removal: Transport materials removed from demolished structures and legally dispose of offsite.

END OF SECTION

CONCRETE

DIVISION 3

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SECTION 03 15 13
WATERSTOPS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work includes PVC and Bentonite waterstops.

1.02 REFERENCES

A. Corps of Engineers: CRD-C 572

B. American Society for Testing and Materials (ASTM)

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Product data describing the waterstops, including dimensions, physical properties of the material, and installation instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store waterstops to protect from oil, dirt, and sunlight.

B. Protect Bentonite waterstops from exposure to moisture that may cause premature waterstop expansion

PART 2 - PRODUCTS

2.01 MATERIALS

A. PVC Waterstops:

1. Waterstops shall be extruded polyvinyl chloride (PVC) of ribbed flange and centerbulb type, 4 inch wide, not less than 3/16 inch thick at the narrowest point, with centerbulb minimum inside diameter of 3/16 inch and outside diameter 3/8 inch, or as indicated on the Drawings.

2. PVC waterstop shall be extruded from virgin resins with no reclaimed or scrap material that is dense, homogeneous, and free from porosity or other imperfections, resistant to portland cement, alkalis, mildews, fungi, and mild (10%) acid solutions, and shall meet or exceed the following:

Property	**Standard**	**Value**
Tensile strength (psi, minimum)	ASTM D638	2,000
Tensile Strength after Accelerated Extraction (psi, min.)	CRD C 572	1,600
Elongation, Ultimate (percent, min.)	ASTM D638	350
Elongation after Accelerated Extraction (percent min.)	CRD C 572	300
Stiffness in Flexure (psi)	ASTM D747	700
Tear Resistance (lbs/in)	ASTM D624	300
Durometer Hardness (Shore A)	ASTM D2240	79 +/- 3
Low Temperature Brittleness (at -35 deg. F)	ASTM D746	Passed
Effect on Alkali after 7 Days:Wt. -0.10%/+0.25% Hardness +/-5 points	CRD C 572	Passed

3. Manufacturers: Greenstreak, Vinylex, or equivalent.

4. Corners and Intersections shall be factory made.

5. Field joints shall be butt style and splices shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer printed recommendations.

B. Bentonite Waterstops

1. Water stops shall be 1 ¼ inch x ½ inch trapezoidal shape with a reinforced poly scrim or as indicated on the Drawings.

2. The material shall meet or exceed the following:

Item	**Standard**	**Criteria**
Butyl Rubber- Hydrocarbon (% by weight)	ASTM D297	25%
Bentonite	SS-S-210-A	75.0%
Volatile matter	ASTM D6	Below 1%
Specific gravity at 77° F	ASTM D71	1.57
Penetration	ASTM D217 150 GTL 300 GTL	 58 85
Flash point	ASTM D93	365

3. Manufacturers: CETCO, or equivalent.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General

1. Waterstops shall be fully continuous for the extent of the joint. Splices shall be accomplished in accordance with the manufacturer's instructions for joint welding. Overlapping waterstop at joints is not permitted.

2. Repair or replace damaged waterstops prior to concrete pours. Seal concrete joints if leaks occur.

3. If not indicated, provide waterstops at all construction joints that constitute an air-liquid interface and extend to 2 feet below grade, where applicable.

B. PVC Waterstops

1. Limit PVC waterstop exposure to direct sunlight to two days.

2. Provide factory made fabrications for multiple joint splices, joints with an angle cut, alignment change, or the joining of dissimilar sections prior to placement.

3. Adequately support waterstops during installation and concrete pours. Ensure reinforcing steel does not interfere with proper positioning of waterstop.

4. Hold waterstop in position in formwork with blocks or wires and support as necessary to maintain shape. Provide factory applied grommets as necessary. Holes in the waterstop material made in the field are prohibited.

C. Bentonite Waterstops

1. Confine waterstop within the concrete joint with a minimum 2 inch concrete cover to the exterior joint surface unless otherwise indicated.
2. Exposed waterstop must not be submerged for any period of time before concrete pour. If swelling occurs prior to confinement, replace with new material.
3. Secure waterstop to existing concrete surface using primer or cut nails as necessary to securely adhere the material in place.
4. Butt ends of waterstops, do not overlap.

3.02 FIELD QUALITY CONTROL

A. Waterstop splicing defects which are unacceptable include, but are not limited to the following:

1. Tensile strength less than 80 percent of the parent section.
2. Misalignment of centerbulb, and ribs greater than 1/16 inch.
3. Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness.
4. Misalignment that reduces waterstop cross section more than 15 percent.
5. Visible porosity in the weld.
6. Bubbles or inadequate bonding.
7. Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.
8. Charred or burnt material.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for all concrete including the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Concrete Tanks.

B. This section also includes the tightness testing of concrete tanks and other environmental structures.

1.02 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials"
2. ACI 301, "Specifications for Structural Concrete"
3. ACI 315, "Details and Detailing of Concrete Reinforcement"
4. ACI 318, "Building Code Requirements for Reinforced Concrete"
5. ACI 350, "Code Requirements for Environmental Engineering Concrete Structures"
6. ACI 350.1, "Tightness Testing of Environmental Engineering Concrete Structures"

B. Concrete Reinforcing Steel Institute (CRSI):

1. CRSI, "Manual of Standard Practice"
2. CRSI, "Recommended Practice for Placing Bar Supports"

C. American Welding Society (AWS):

1. AWS D1.4, "Structural Welding Code – Reinforcing Steel"

D. American Society for Testing and Materials (ASTM): Latest edition for each specified throughout.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, placement, and comply with ACI 315. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Include special reinforcement required at openings in concrete. Coordinate with contract drawings so that reinforcing steel will not interfere with embedded items cast in concrete.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Engineer.

E. Product Data and Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Curing compounds.
6. Floor and slab treatments.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.

F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates, include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
2. Alkali Silica Reactivity (ASR) results.
3. Submit per ASTM C 157 data for shrinkage test for environmental concrete. Average length change at 28 days shall be limited to 0.04%. Values exceeding 0.04% will be rejected.
4. Submit per ASTM C 457 hardened concrete air content for environmental concrete. The maximum air void spacing factor shall be 0.008 inch. Specific surface (surface area of voids) shall be 500 in^2 per cubic inch of air void volume, or greater.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.

Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction**,** qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as MCA/ACI Concrete Field Testing Technician, Grade 1.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. Concrete Testing Service: Contractor shall engage a qualified independent testing agency to perform material evaluation tests.

E. Preinstallation Conference: Conduct conference at Project site.

1. Before using onsite, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete Subcontractor.
   e. Special concrete finish Subcontractor.

2. Review testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, and concrete protection.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle concrete materials and Ready-Mixed Concrete in a manner to prevent damage and inclusion of foreign substances.

B. Protect concrete accessories from weather and direct exposure to sunlight prior to installation.

C. Deliver, store, and handle steel reinforcement to prevent bending and damage. Bundle steel reinforcement and tag to facilitate sorting and placing. A sufficient supply of approved steel reinforcement shall be stored onsite at all times to ensure that there will be no delay of the work.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Surface Finish-2.0 (SF-2.0) Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Surface Finish-1.0 (SF-1.0) Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent curing or treatments of concrete surfaces. Coatings containing mineral oils or other non-drying ingredients will not be permitted.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

3. Provide ties with waterstops for all areas in contact with water, and all exposed below grade construction.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Welded Reinforcing Bars: ASTM A 706, Grade 60, deformed

C. Plain-Steel Wire: ASTM A 82, wire ties shall be 16 gage black or galvanized.

D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Wood, wood stakes, brick, etc. are not acceptable to be used within the concrete. Manufacture bar supports from galvanized steel wire, or approved plastic accessories according to CRSI's "Manual of Standard Practice," and as follows:

1. For concrete surfaces exposed to view or in contact with water where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2. For concrete over waterproof membranes and/or vapor barrier membranes use cradle, pad, or base type supports which will not puncture the membrane.

3. Individual and continuous slab bolsters and chairs shall be of type to suit various conditions encountered and must be capable of supporting 300 lb load without damage or permanent distortion.

4. Unless otherwise indicated on Drawings, bottom reinforcing bars in building footings shall be supported by precast concrete bricks/dobies or individual chairs.

5. Use alternate methods where base material will not support chair legs.

2.04 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I, or II.

a. Fly Ash: ASTM C 618, Class C, with loss on ignition less than 4%.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 80 or 100 with a maximum blaine fineness of 400 square meters per kilogram.
c. Blended Cement: ASTM C 595

B. Normal-Weight Aggregates: ASTM C 33, aggregates shall be non-reactive and provided from a single source.

1. Coarse Aggregate shall be Class 3S or better. Gradiation of blended coarse aggregates shall conform to blending requirements of ASTM C 33. Maximum aggregate size shall be as specified.

2. Fine Aggregate: MDOT 2NS.

3. Combined aggregate shall be well graded from coarse to fine sizes, and shall be graded between screen sizes to produce concrete that has optimum workability and consolidation characteristics.

C. Water: ASTM C 94; potable.

D. Alkali Silica Reactivity (ASR): Submit documentation to the Engineer that the concrete mixture for exterior exposure does not present the potential for excessive expansion caused by alkali-silica reactivity. Testing may be from other projects or from records provided by the aggregate suppliers. Provide the latest test results (valid for 2 years) conforming to the specified criterion for one of the following standard test methods for the material to be used in the project.

1. ASTM C 1260. Mortar Bar Test. If the expansion of the mortar bars is less than 0.10 percent at 14 days of immersion, the aggregate is considered non-deleterious to ASR reactivity and may be used in the concrete.

2. ASTM C 1293. Concrete Prism Test. If the expansion of concrete prisms is not greater than 0.040 percent after 1 year, the aggregate is considered non-deleterious to ASR reactivity and may be used in the concrete.

If the concrete mixture exceeds the limits in the ASTM used, then the Engineer will not approve the use of that concrete mixture.

If no previous test data are available for the concrete mixture that shows it is resistant to ASR, mitigate the potential for ASR using either Method 1 or 2 as follows.

3. Method 1. Replace 25 to 40 percent of the Portland cement in the concrete mixture with Class C fly ash or Slag Cement (Grade 100 minimum). A blended cement meeting the requirements of ASTM C 595 containing Portland cement and slag cement or Class C fly ash may also be used.

Demonstrate the ability of the fly ash or slag cement to control the deleterious expansion caused by ASR by molding and testing mortar bars according to the standard test method described in ASTM C 1567 using the mix proportions for both the aggregates and the cementitious materials-aggregate combination. If the average of three mortar bars for a given cementitious materials-aggregate combination produces an expansion less than 0.10 percent at 14 days of immersion, the mix associated with that combination will be considered non-deleterious to ASR reactivity. If the average expansion is 0.10 percent or greater, the mix associated with that combination will be considered not sufficient to control the deleterious expansion caused by ASR and the mix will be rejected.

4. Method 2. Use Low-Alkali cement with equivalent alkalis (Na_2O + 0.658 x percent K_2O) not exceeding 0.60 percent. The total alkali content for the cementitious materials combination must not exceed 3.0 pounds per cubic yard (Na_2O equivalent).

2.05 ADMIXTURES

A. Concrete admixtures shall be produced by a single manufacturer.

B. Air-Entraining Admixture: ASTM C 260.

C. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.

2. Retarding Admixture: ASTM C 494, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.06 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class B, 10 mils minimum. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include:
   a. Grace Construction Products, W. R. Grace & Co.; Florprufe 120, or equivalent.

2.07 LIQUID FLOOR TREATMENTS

A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products:
   a. L&M Construction Chemicals, Inc.; Seal Hard, or equivalent.

2.08 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet. Polyethelyne film shall be white opaque sheeting manufactured from virgin resin and shall contain no scrap or additives.

D. Water: Potable.

E. Membrane-Curing Compound: Clear, Waterborne ASTM C 309, Type 1-D, L&M Construction Chemicals, Inc.; Cure R, or equivalent. Use ASTM C 309, Type 2, L&M Construction Chemicals, Inc.; Cure R-2, or equivalent for exterior concrete paving and sidewalk surfaces.

2.09 RELATED MATERIALS

A. Isolation Joint Material: 15# Building Felt.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, by W. R. Meadows, or equivalent.

C. Semirigid Joint Filler/Sealant: Use two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80, Metzger/McGuire, MM-80, or equivalent for interior vehicle traffic slabs. Use two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 75, SL75, VersaFlex, or equivalent for exterior vehicle traffic slabs. Use multi-component, polyurethane complying with ASTM C 920, Type M, Grade NS, MasterSeal NP 2, or equivalent for other concrete joints.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

2. Ground Granulated Blast-Furnace Slag: 50 percent.

3. Combined Fly Ash and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash not exceeding 25 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability. Concrete shall not contain more than one water-reducing admixture

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

4. Slump limits may be increased by 2” when using a water-reducing admixture.

2.11 CONCRETE MIXTURES

A. Exterior Slabs-on-Grade, Pavements, and Sidewalks (including Stairs and Ramps): Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.45.

3. Maximum Aggregate Size: 1” (similar MDOT 6AA).

4. Slump Limit: 3 inches maximum.

5. Air Content: 6.5 percent, plus or minus 1.5 percent at point of delivery for exterior exposure. Maximum of 3 percent for interior trowel finished slabs.

B. Headworks & Treatment Building Concrete; all Slabs, Walls, and Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Cement shall be Type II cement or equivalent.

3. Maximum Water-Cementitious Materials Ratio: 0.45.

4. Maximum Aggregate Size: 1” (similar MDOT 6AA).

5. Slump Limit: 4 inches maximum.

6. Air Content: 6.5 percent, plus or minus 1.5 percent at point of delivery for exterior exposure. Maximum of 3 percent for interior trowel finished slabs.

C. Concrete Topping and Infill: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.50.

3. Maximum Aggregate Size: 3/8” (similar MDOT 26A).

4. Slump Limit: 4 inches maximum.

5. Air Content: 6.5 percent, plus or minus 1.5 percent at point of delivery for exterior exposure.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement per the details indicated on the construction drawings and engineer approved shop drawings, ACI 315, and according to CRSI's "Manual of Standard Practice." Bars shall be cold bent, heating of reinforcement for bending will not be permitted.

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK

A. Installer shall be responsible to design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Metal pinch bars shall not be used against concrete and special care shall be taken to protect concrete.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Chamfer exterior corners and edges of permanently exposed concrete, ¾" x ¾".

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items. Troweled keyways will not be allowed.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement. Do not allow form-release agent to contact steel reinforcement, or hardened concrete against which new concrete is to be placed.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.03 REMOVING AND REUSING FORMS

A. Vertical Formwork: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

B. Horizontal/Supporting Formwork: Formwork for beam soffits, joists, above-grade slabs, retaining walls, and other structural elements may be removed after curing for 10 days after placement and concrete has obtained design minimum 28 day compressive strength.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.04 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

2. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete

3.05 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Spacing of supports and accessories shall conform with CRSI's "Recommended Practice for Placing Bar Supports." Do not tack weld crossing reinforcing bars.

D. Splice steel reinforcement in compliance with ACI 318 or ACI 350 where required for minimum laps, no less than 12 inches. Wherever possible, splices of adjacent bars shall be staggered. Place bars in contact and tightly tie with wire or use mechanical connectors as required. Splices shall not be welded.

E. Bending of steel reinforcement dowels after placement of concrete will not be permitted.

F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

G. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing, no less than 10 inches. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.06 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated and per approved construction joint layout submittal.

C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints in interior slabs as shown on the drawings, where no specific indication is given, space joints in a 90 degree crossing pattern 20 foot maximum each direction:

1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Expansion/Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated. Additionally at slabs to remain exposed to the exterior provide expansion joints in a 90 degree crossing pattern 30 foot on center maximum, placing control joints midway between expansion joints.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

E. Construction Joints in Walls: Install construction joints at locations as indicated and as outlined below.

1. In walls greater than 25 foot in length space joints to ensure a continuous length of wall is no greater than four times its height, and never greater than at 40 foot.

2. At changes in wall height or thickness.

3. On one side of each pier/pilaster poured contiguous with the wall.

4. At openings place joints on one side of an opening less than 6 feet in width and on both sides for openings 6 feet in width and greater.

5. In line with each construction/control joint of masonry bearing on the wall.

3.07 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Contractor shall not add water to concrete during delivery, at Project site, or during placement.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation. Limit freefall of concrete to 4’.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301. Operators to have been trained in the use of the mechanical vibrating equipment.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

3. A sufficient number of mechanical vibrators shall be on hand to ensure that the incoming concrete can be properly compacted. Reserve vibrators shall be in hand for when others are being serviced. No placement of any concrete shall commence with a single vibrator on hand.

D. Deposit and consolidate concrete for footings, floors, slabs, and walls in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on supports during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low daily temperature is expected to fall below 40 deg F for three successive days, deliver and maintain placed concrete mixture temperature within the temperature range required by ACI 306.1. For concrete less than 12 inches in least dimension the minimum concrete temperature shall be 55 deg F, and for concrete between 12 inches and 36 inches in least dimension the minimum concrete temperature shall be 50 deg F.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Surfaces to be in contact with the concrete shall be at a temperature as near as practical to that of the concrete being placed

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.

4. Concrete in place shall be maintained at the specified minimum temperature by keeping forms in place, covering with insulated blankets, heated enclosures or combinations of these for the following minimum time intervals. Footings and walls below grade and slabs on grade, 2 days. Exposed walls and columns with no load, 3 days. Exposed floor slabs, beams and girders above grade and partially loaded, 6 days. In no case shall forms be removed in less time than specified in Section 3.03.

F. Hot-Weather Placement: Comply with ACI 301 and as follows: Hot weather is any combination of high ambient temperature, high concrete temperature, low relative humidity, wind speed and solar radiation conditions that impair the quality of concrete.

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.

2. Where the temperature of the concrete being placed is consistently above 75 deg F and a noticeable decrease in slump occurs, a retarding admixture may be used.

3. Unformed surfaces of concrete placed during hot weather shall be protected from drying by continuous moist curing for at least 24 hours. Curing shall be started as soon as the concrete has hardened sufficiently to withstand surface damage. If moist curing is not continued beyond 24 hours, the surface while damp shall be covered with a suitable heat-

reflecting plastic membrane or sprayed with a white pigmented curing compound for the remainder of the required curing.

3.08 FINISHING FORMED SURFACES

A. Surface Finish-1.0 (SF-1.0), per ACI 301 and modified here: As-cast concrete texture imparted by form material with voids and defects that exceed 1 inch wide or ½ inch deep repaired and patched. Remove fins and other projections that exceed 1 inch for SF-1.0 formed-surface irregularities.

1. Apply to concrete surfaces not exposed to view.

B. Surface Finish-2.0 (SF-2.0), per ACI 301 and modified here: As-cast concrete texture imparted by form material, arranged with a minimum of seams. Repair and patch voids and defects that exceed ¾ inch wide or ½ inch deep. Repair and patch tie holes. Remove fins and other projections that exceed 1/8 inch for SF-2.0 formed-surface irregularities.

1. Apply to concrete surfaces exposed to view and to interior surfaces of environmental structures.

C. Surface Finish-3.0 (SF-3.0), per ACI 301 and modified here: As-cast concrete texture imparted by form material appropriate for a rubbed finish. Repair and patch voids and defects that exceed ½ inch wide or ½ inch deep. Repair and patch tie holes. Remove fins and other projections that exceed 1/8 inch for SF-3.0 formed-surface irregularities.

1. Apply to exterior exposed above grade walls that are part of building structures and apply a rubbed finish per ACI 301.

3.09 FINISHING UNFORMED SURFACES

A. General: After proper and adequate consolidation and tamping, all unformed top surfaces of slabs, floors, walls and curbs shall be brought to a uniform surface with suitable tools. The classes of finish specified for unformed concrete surfaces are designated below. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies before excess moisture or bleedwater appears on surface. Evaporation retarder may be used as conditions warrant.

1. Do not further disturb surfaces before starting finishing operations.

C. Finish U1: Sufficient leveling and screeding to produce an even, uniform surface with irregularities not to exceed 3/8 inch. No further special finish is required.

D. Finish U2: After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excessive moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed ¼ inch. Joints and edges shall be tooled as indicated.

E. Finish U3: After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free form blemishes, ripples and trowel marks. The finish shall be smooth and free of all irregularities.

F. Finish U4: Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, the surface shall be given a fiber-bristle broom finish with broom perpendicular to drainage or main traffic route unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid/nonslip finish.

G. Unformed Surfaces: Surfaces shall be finished according to the following.

1. Grade slabs and foundations to be covered with concrete or fill material. (U1)

2. Slabs and floors to be covered with topping grout. (U2)

3. Slabs and roofs to be covered with built-up or membrane roofing. (U2)

4. Interior slabs and floors to receive architectural finish. (U3)

5. Exterior slabs, sidewalks, concrete platforms, steps, ramps, and aprons. (U4)

6. Environmental structures water bearing slabs with slopes 10 percent or less. (U3)

7. Tops of walls. (U3)

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Embedded Stair Nosing: Install stair nosing in concrete as shown on Drawings.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Cure concrete for a minimum of 7 days. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings, and penetrating liquid floor treatments.
b. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

   Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

E. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer’s approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean and dampen with water. Fill and compact with patching mortar. Fill form-tie voids with patching mortar.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match

before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.

3.14 FIELD QUALITY CONTROL

A. Testing: Contractor shall engage a qualified testing agency to perform field tests and prepare test reports. All testing costs shall be part of the Contractor's base bid. All test reports shall be provided by the testing agency to the Owner and Engineer.

B. Inspections: Contractor shall coordinate with Engineer for allowing observation of noted items below, but not limited to:

1. Steel reinforcement placement.

2. Headed bolts and studs.

3. Verification of use of required design mixture.

4. Concrete placement, including conveying and depositing.

5. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 31 and ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample, four specimens, for each day's pour of each concrete mixture less than 50 cu. yd., plus additional sets of four specimens for each additional 50 cu. yd. or fraction thereof.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture or every other concrete delivery truck. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days and one set of two laboratory cured specimens at 28 days.

a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

6. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

7. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain

Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

9. Additional Tests: Testing agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.

10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.15 TIGHTNESS TESTING

A. Testing: Contractor shall perform testing per ACI 350.1 for all new construction of tanks, channels, and other environmental structures. Record information shall be submitted for approval to the engineer

1. Testing shall meet both HST-VIO and HST-050

END OF SECTION

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SECTION 03 41 13
PRECAST STRUCTURAL CONCRETE HOLLOW CORE PLANKS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work includes all prestressed, precast hollow core plank concrete sections as shown on the Drawings, related bearing and concrete accessories. The design of the concrete sections shall be by the manufacturer.

1.02 REFERENCES

A. ACI 301, "Specification for Structural Concrete for Buildings".

B. ACI 318, "Building Code Requirements for Reinforced Concrete".

C. AASHTO, "Standard Specifications for Highway Bridges".

D. AWS D1.1, "Structural Welding Code".

E. ASTM, "American Society for Testing and Materials".

F. PCI, "Prestressed Concrete Institute".

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Shop and erection drawings are required for all prestressed, precast concrete. Design calculations and a description of the method of prestressing are required and must be prepared and signed by a Professional Engineer registered in the State of Michigan.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products from one of the following:
   1. Stres Core Inc.
   2. Kerkstra Precast Inc.

2.02 MATERIALS

A. Concrete
   1. Cement shall conform to ASTM C150, Type I or Type III.
   2. Aggregate shall conform to ASTM C33.
   3. Lightweight Aggregate shall conform to ASTM C330.
   4. Mixing water shall be clean, fresh, and potable.
   5. Admixtures, if used, shall conform to the appropriate specifications listed below:
      a. Air entraining admixtures: ASTM C260.
      b. Water reducing, retarding, and accelerating admixtures: ASTM C494. Calcium chloride shall not be used as an admixture.

B. Prestressing strands shall be uncoated, 7-wire, stress-relieved strand conforming to ASTM A416, Grade 250K or 270K.

C. Reinforcement
   1. Reinforcing bars shall be deformed bars conforming to ASTM A615, ASTM A616, ASTM A617, or ASTM A706.
   2. Welded wire fabric shall conform to ASTM A185.

D. Anchors and inserts shall conform to ASTM A36 and shall be hot-dip galvanized according to ASTM A153.

E. Grout shall be per manufacturer's recommendations or a 2:3:1 mixture of Portland cement, sand, and non-shrink admixture. Water shall be added to obtain the consistency required for the work.

F. Bearing pads shall be per plan and conform to Division 2, Section 25 of the AASHTO Standard Specifications for Highway Bridges.

G. Welded studs shall be in conformance with AWS D1.1.

2.03 FABRICATION

A. Procedures and tolerances shall be in conformance with Prestressed Concrete Institute MNL-116, "Manual for Quality Control for Plants and Production of Precast, Prestressed Concrete".

B. Furnish units that are free of voids or honeycomb, with straight true edges and surfaces.

C. Concrete mix shall produce a minimum compressive strength, f'c of 5000 psi and a minimum compressive strength at release of 3500 psi.

D. Include cast-in weld plates where required for anchorage or lateral bracing to structural steel members.

E. Sections shall be manufactured in accordance with approved shop drawings. Units shall be clearly marked for certification.

F. Finishes
   1. Top: Standard finish: Result of vibrating screed and additional hand finishing at projections. Normal color variations, minor indentations, minor chips and spalls will be permitted. No major imperfections, honeycomb, or defects will be permitted.
   2. Underside: Architectural Grade B Finish: All air pockets and holes over 1/4 inch in diameter shall be filled with a sand-cement paste. All form offsets or fins over 1/8 inch shall be ground smooth.
   3. Ends: Strands shall be recessed and the recesses filled with a non-staining, non-shrink material.

G. Openings larger than 10 inches round or square shall be provided by the manufacturer as shown on the approved shop drawings. Other openings shall be located and field drilled after erection. Openings shall be approved by the Manufacturer before drilling or cutting. The Contractor shall be responsible for coordinating the location and dimensions of all openings required by the various trades.

PART 3 - EXECUTION

3.01 TRANSPORTATION

A. Precast concrete members shall be lifted and supported only at lifting or supporting points shown on the shop drawings. All lifting devices shall have a minimum safety factor of 4.

B. Transportation and storage shall be performed with equipment and methods so as to minimize damage.

C. Any damaged areas shall be repaired and approved according to manufacturer's recommendations, or the member shall be replaced prior to erection.

3.02 ERECTION

A. Lift, place and secure each precast unit in the position indicated on the approved erection drawings and in accordance with manufacturer's printed instructions.

B. Units shall be aligned and leveled. The joints shall be uniform with a minimum 1/2-inch gap and a tolerance of ± 1/8 inch. Shims may be provided as approved by the Engineer.

C. Anchorages and attachments shall be made as indicated on the approved shop drawings. Field welding shall be done by a qualified welder in accordance with AWS D1.1. Grout shall be of the type specified. The top of the grout shall be troweled smooth and all extruded grout removed from the underside.

END OF SECTION

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SECTION 03 41 33
PRECAST STRUCTURAL CONCRETE DOUBLE TEES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work includes all prestressed, precast double tee concrete sections as shown on the Drawings, related bearing and concrete accessories. The design of the concrete sections shall be by the manufacturer.

1.02 REFERENCES

A. ACI 301, "Specification for Structural Concrete for Buildings".

B. ACI 318, "Building Code Requirements for Reinforced Concrete".

C. AASHTO, "Standard Specifications for Highway Bridges".

D. AWS D1.1, "Structural Welding Code".

E. ASTM, "American Society for Testing and Materials".

F. PCI, "Prestressed Concrete Institute".

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Shop and erection drawings are required for all prestressed, precast concrete. Design calculations and a description of the method of prestressing are required and must be prepared and signed by a Professional Engineer registered in the State of Michigan.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products from one of the following:
1. Kerkstra Precast Inc.
2. ATMI Precast

2.02 MOLD MATERIALS

A. Molds: Rigid, stable, nonabsorptive material, warp and buckle free, that will provide precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required surface finishes.

1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or affect hardening of precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.03 REINFORCING MATERIALS

A. Reinforcing Bars: Shall be deformed bars conforming to ASTM A615, ASTM A616, ASTM A617, or ASTM A706.

B. Welded wire fabric shall confirm to ASTM A185.

2.04 PRESTRESSING TENDONS

A. Prestressing Strand: Shall be uncoated, 7-wire, stress-relieved strand conforming to ASTM A416, Grade 250K or 270K.

2.05 CONCRETE MATERIALS

A. Cement shall conform to ASTM C150, Type I or Type II.

B. Aggregate shall conform to ASTM C33.

C. Lightweight Aggregate shall conform to ASTM C330.

D. Mixing water shall be clean, fresh, and potable.

E. Admixtures, if used, shall conform to the appropriate specifications listed below:

1. Air entraining admixtures: ASTM C260.

2. Water reducing, retarders, and accelerating admixtures: ASTM C494. Calcium chloride shall not be used as an admixture.

2.06 STEEL CONNECTION MATERIALS AND ACCESSORIES

A. Anchors and inserts shall conform to ASTM A36 and shall be hot-dip galvanized according to ASTM A153.

B. Welded studs shall be in conformance with AWS D1.1.

2.07 BEARING PADS

A. Bearing pads shall be per plan and conform to Division II, Section 18 of the AASHTO Standard Specifications for Highway Bridges.

1. Elastomeric Pads: AASHTO M251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer according to ASTM D2240, minimum tensile strength 2250 psi (15.5 MPa) per ASTM D412.

2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer according to ASTM D2240. Capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting or delaminating in the internal portions of the pad.

3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer according to ASTM D2240.

2.08 GROUT MATERIALS

A. Grout shall be per manufacturer's recommendations or a 2:3:1 mixture of Portland cement, sand, and non-shrink admixture. Water shall be added to obtain the consistency required for that work.

2.09 FABRICATION

A. Procedures and tolerances shall be in conformance with Prestressed Concrete Institute MNL-116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products".

B. Furnish units that are free of voids or honeycomb, with straight true edges and surfaces.

C. Concrete mix shall produce a minimum compressive strength, f'c of 5000 psi and a minimum compressive strength at release of 3500 psi.

D. Include cast-in weld plates where required for anchorage or lateral bracing to structural steel members.

E. Sections shall be manufactured in accordance with approved shop drawings. Units shall be clearly marked for certification.

F. Openings larger than 10 inches round or square shall be provided by the manufacturer as shown on the approved shop drawings. Other openings shall be located and field drilled after erection. Openings shall be approved by the Manufacturer before drilling or cutting. The Contractor shall be responsible for coordinating the location and dimensions of all openings required by the various trades.

G. Tolerances: Fabricate structural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 or PCI MNL 135 product tolerances as well as position tolerances for cast-in items.

H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete members.

J. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.

2.10 FINISHES

A. Top Screed Finish for Unformed Surface: Standard finish: Result of vibrating screed and additional hand finishing at projections. Normal color variations, minor indentations, minor chips and spalls will be permitted. No major imperfections, honeycomb, or defects will be permitted.

B. Underside: Architectural Grade B Finish: All air pockets and holes over 1/4 inch in diameter shall be filled with a sand-cement paste. All form offsets or fins over 1/8 inch shall be ground smooth.

C. Ends: Strands shall be recessed and the recesses filled with a non-staining, non-shrink material.

D. Apply roughened surface finish in accordance with ACI 318 to precast concrete members that will receive concrete topping after installation.

PART 3 - EXECUTION

3.01 TRANSPORTATION

A. Precast concrete members shall be lifted and supported only at lifting or supporting points shown on the shop drawings. All lifting devices shall have a minimum safety factor of 4.

B. Transportation and storage shall be performed with equipment and methods to minimize damage.

C. Any damaged areas shall be repaired and approved according to manufacturer's recommendations, or the member shall be replaced prior to erection.

3.02 ERECTION

A. Lift, place and secure each precast unit in the position indicated on the approved erection drawings and in accordance with manufacturer's printed instructions.

B. Units shall be aligned and leveled. The joints shall be uniform with a minimum 1/2 inch gap and a tolerance of $\pm$ 1/8 inch. Shims may be provided as approved by the Engineer.

C. Anchorages and attachments shall be made as indicated on the approved shop drawings. Field welding shall be done by a qualified welder in accordance with AWS D1.1. Grout shall be of the type specified. The top of the grout shall be troweled smooth and all extruded grout removed from the underside.

END OF SECTION

SECTION 03 60 00
GROUT

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes installation of cementitious grout for structural steel column base plates, bearing plates, pipe supports, railing posts, equipment bases etc. as shown on Drawings.

B. The following types of grout are covered in this Section:

1. Shrinkage-resistant Grout. This type is to be used unless noted otherwise.

2. Epoxy Grout.

1.02 REFERENCES

A. Corps of Engineers: CRD-C 621

B. American Society for Testing and Materials (ASTM). Latest edition for each specified throughout.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Submit product data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Shrinkage-resistant Grout.

2. Epoxy Grout.

C. Submit shop drawings, including setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other Sections.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Non-metallic Shrinkage-Resistant Grout: Premixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents with minimum compressive strength of 6,000 psi at 28 days, complying with ASTM C 1107 and Corps of Engineers CRD-C 621. Subject to compliance with the requirements, provide one of the following:

1. "Hi-Flow Grout"; Euclid Chemical Co.

2. "Crystex"; L & M Construction Chemicals, Inc.

3. "MasterFlow 928"; BASF.

4. "Five Star Grout"; Five Star Products Inc.

B. Epoxy Grout: High strength, chemically resistant foundation grout for equipment bases with minimum compressive strength of 10,000 psi at 28 days when tested in accordance with ASTM C 579. Subject to compliance with the requirements, provide one of the following:

1. "MasterFlow 648"; BASF.

2. “HP Epoxy Grout"; Five Star Products Inc.

3. “Epogrout 758”, L&M Construction Chemicals.

PART 3 - EXECUTION

3.01 GENERAL

A. For pre-packaged/pre-mixed grouts all mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution shall be done according to the instructions and recommendations of the manufacturer.

3.02 PLACEMENT OF GROUT

A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean thoroughly with liberal quantities of water, leaving concrete saturated but free of standing water.

B. The minimum thickness of grout shall be 1 inch unless noted otherwise.

C. Clean Bottom surface of base and bearing plates. Set loose and attached base plates and bearing plates for structural steel members on steel wedges or other steel adjusting devices.

D. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

E. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

END OF SECTION

MASONRY

DIVISION 4

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PART 1 - GENERAL

1.01 DESCRIPTION:

A. This Section includes the following:

1. 12” Single Score Insulated Concrete Masonry Wall Units.
2. Masonry reinforcing and anchors.
3. Masonry accessories.
4. Standard 8” CMU block at interior wall meeting requirements listed in this specification.

B. Products installed but not furnished under this Section include the following:

1. Steel lintels in unit masonry are specified in Section 05 50 00 – "Metal Fabrications."
2. Wood nailers and blocking built into unit masonry are specified in Section 06 10 00 – "Rough Carpentry."
3. Hollow metal frames in unit masonry openings are specified in Section 08 11 13 – "Hollow Metal Doors and Frames."
4. Electrical conduits, wall penetrations, and electrical accessories specified in Division 26.

1.02 RELATED SECTIONS

A. SECTION 07 62 00 – “Flashing and Sheet Metal”

B. SECTION 23 37 00 – “Air Outlets and Inlets”

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – “Submittals.”

B. Submittal Requirements:

Specified Items	Product Data	Shop Dwgs.	Samples	Mfg. Matl. Certif.	Matl. Test Reports
Insulated concrete masonry units	X		X		X
Mortar & grout materials	X			X	
Mortar & grout mixes	X				X
Rebar		X			
Horiz. Jt. Reinf. *	X				
Ties & anchors *	X				
Accessories * Exp Jt/C.J./ Bond Breaker/Weeps/ Vents	X				
Cleaners *	X				

1. Submittals for Items Identified by Asterisk (*): If products will be supplied to the project exactly as specified, supplier may at his option submit a letter of certification listing products being used and identifying manufacturer and model number. Provided information is adequate to verify conformance with specifications, no other submittals will be required for those items.

1.04 QUALITY ASSURANCE

A. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 "Specifications for Masonry Structures".

B. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color from one manufacturer for each different product required.

C. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, and color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

D. Before laying finish concrete masonry units, build a minimum 4 foot wide sample panel to show representative workmanship, all coursing, patterns, range, color, and mortar joints. Sample shall be laid to include all colors and types of masonry on the building exterior. Sample panel may be part of the final construction if approved by the Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials to project in original undamaged containers.

B. Store and handle masonry units and insulation off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants,

corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.

C. Store cementitious materials off the ground, under cover, and in dry location.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.

1.06 PROJECT CONDITIONS:

A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, or soil that comes in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, and similar products from mortar droppings.

D. Cold-Weather Construction: Comply with referenced unit masonry standard for cold-weather construction. Do not lay masonry units that are wet or frozen. Remove masonry damaged by freezing conditions.

1. Heat mixing water when air temperature is below 40 degrees F and heat aggregates and mixing water when air temperature is below 32 degrees F to ensure mortar temperatures between 40 degrees F and 120 degrees F until used. Antifreeze ingredients are prohibited.

2. When conditions warrant, temperatures of materials shall be measured and frozen sand and wet masonry units thawed. Do not lay units having a film of water or frost on their surfaces.

E. Hot-Weather Construction: Comply with referenced unit masonry standard.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Insulated concrete masonry wall units are a single wythe wall assembly that meets prescriptive insulation requirements for above grade mass wall construction and shall comply with referenced unit masonry standards and other requirements specified in this Specification applicable to each material indicated.

1. Insulated Concrete Masonry Wall Units shall be Omni Block as manufactured by an approved, licensed manufacturer or Engineer approved comparable product complying with this Specification.

2. Insulated Concrete Masonry Wall Units for Climate Zone 6 shall have a maximum U-value for constructed wall assembly of U = 0.08.

2.02 INSULATED CONCRETE MASONRY UNITS

A. General: Provide special shapes where indicated on the Drawings and at lintels, corners, jambs, sash, control joints, headers, for bonding other special conditions. Provide square edge units for outside corners unless indicated otherwise. Provide bullnose corners on all interior and exterior window sills unless indicated otherwise.

B. Insulated Concrete Masonry Units:

1. Size: Standard modular unit sizes - 11-5/8" x 7-5/8" x 15-5/8" (Single Score). Other sizes where indicated on the Drawings.

2. Block Design:

a. No direct cross webs (thermal path shall be extended to approximately 16 inches).

b. Offset cross webs shall create three (3) rows of cells (interior, middle, and exterior) that are individually filled with molded Expanded Polystyrene (EPS) insulation inserts.

3. Exposed surfaces: Manufacturer's standard color split faced block unless indicated otherwise.

a. Admixtures: Masonry block shall be treated with water repellent admixture; Dry-Block as manufactured by W.R. Grace, or MasterPel as manufactured by BASF. Furnish manufacturer’s recommended water repellent mortar additive for mortar to be used with this product.

4. Classification:

a. Hollow Load Bearing Units: ASTM C90, weight classification – medium weight or as required to meet climate zone insulation requirements, prism strength of f’m = 2000 psi.

2.03 MORTAR AND GROUT

A. Materials:

1. Portland Cement: ASTM C150, Type I.

2. Masonry Cement: ASTM C91.

a. Products: Subject to compliance with requirements, provide products by one of the following:

1) LaFarge/Holcim Group.

2) St. Mary's Cement Group.

3. Ready Mixed Mortar: ASTM C1142.

4. Hydrated Lime: ASTM C207.

5. Quicklime: ASTM C5.

6. Aggregate for Mortar: ASTM C144, except aggregate graded with 100% passing No. 16 sieve for joints less than 1/4".
   a. White Mortar Aggregates: Natural white sand or ground white stone.
   b. Colored Mortar Aggregates: Ground marble, granite, or other sound stone, as required to match block color.
7. Mortar Cement: Prepackaged Type N or S mortar cement meeting the requirements of ASTM C1329, "Standard Specification for Mortar Cement". Mortar cement mortar must meet either the property or proportion specification of ASTM C270, "Standard Specification for Mortar for Unit Masonry".
   a. Manufacturers: St. Mary's Cement Group.
8. Water: Clean and potable.

B. Mixes

1. Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless specifically indicated.
   a. Do not use calcium chloride in mortar or grout.
2. Mortar for Unit Masonry: Comply with ASTM C270 for types of mortar indicated below:
   a. Masonry Below Grade and in Contact with Earth: Type S.
   b. Reinforced Masonry: Type S.
   c. Exterior, above-grade loadbearing and nonloadbearing walls and parapet walls; for interior loadbearing walls; for interior nonloadbearing partitions, and for other applications where another type is not indicated, use Type N.
3. Grout for Unit Masonry: Comply with ASTM C476 and referenced unit masonry standard. Grout strength to be 2000 psi, slump to be 9-11 inches.
4. Non-Chloride Accelerator: ACCELGUARD 80 as manufactured by Euclid Chemical Co.; Freezban NC as manufactured by Chem-Masters Corporation, or other non-chloride accelerator which meets ASTM C494, Type E.

2.04 REINFORCING STEEL

A. Comply with requirements of referenced unit masonry standard and this article.

B. Steel Reinforcing Bars: Billet Steel per ASTM A615, Grade 60.

2.05 HORIZONTAL JOINT REINFORCEMENT

A. Prefabricated hot dip galvanized welded wire units complying with the referenced unit masonry standard. Provide units with continuous 9 Ga plain side rods and continuous 9 Ga plain cross rods spaced 16" O.C. maximum O.C. Out to out spacing of side rods to be 2" less than nominal wall. Provide prefabricated corner and tee units.

1. Galvanized carbon steel wire, coating class for various applications as follows:
   a. Interior Walls: ASTM A641, Class 1.
   b. Exterior Walls or Interior Walls Exposed to Moist Environments: ASTM A153, Class B2.

B. Products:

1. Single Wythe and Composite Masonry Walls:

a. Un-reinforced Block Wall, 120 Truss Mesh, Hohmann & Barnard, Inc.

b. Reinforced Block Wall, 220 Ladder Mesh, Hohmann & Barnard, Inc.

c. Or Equivalent.

2.06 MISCELLANEOUS MASONRY ACCESSORIES

A. Bond Breaker Strips: Asphalt saturated organic roofing felt complying with ASTM D226, Type I (No. 15 asphalt felt).

B. Column Isolation Material: Column Boxboard as manufactured by Williams Products, Inc., or equivalent; asphalt impregnated cellular paper, black, single 1/4-inch thickness or double 1/2-inch thickness.

C. Compressible Filler: Everlastic Neoprene Type NN-1, 1040 Series, closed cell gasket, conforming to ASTM D1056, Type RE41, thickness and width shown or as otherwise required with 15 percent to 25 percent compression, as manufactured by Williams Products, Inc, or equivalent.

D. Expansion Joint Cover: Expand-O-Flash Type WS 4-6-4 copper, vertical wall expansion joint cover as manufactured by Johns-Manville, or equivalent.

2.07 MASONRY WALL INSULATION

A. Provide masonry wall insulation inserts designed and sized to fit cavity of insulated concrete masonry wall units:

1. Molded Expanded Polystyrene (EPS) inserts, recyclable, Non CFC, UL Listed ‘non-toxic’ product that is fluted for moisture migration.

2. Inserts shall be designed and sized to fit into the designed cavity for block inserts and include non-mortar interfering indents (vertically and horizontally).

2.08 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.

B. For masonry not subject to metallic oxidation stains.

1. Sure Klean No. 600 detergent, Prosoco, Inc.

C. For dark colored masonry not subject to metallic oxidation stains:

1. Sure Klean No. 101 lime solvent, Prosoco., Inc.

D. For masonry subject to metallic oxidation stains:

1. Sure Klean Vana Trol, Prosoco., Inc.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

C. Report unsatisfactory conditions to the Engineer. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in Project.

B. Thickness: Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.

C. Build chases and recesses as required to accommodate items specified in this and other Sections of the Specifications. Provide not less than 8 inches of masonry between chase or recess and jamb of openings and between adjacent chases and recesses.

D. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.

E. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of new masonry with existing masonry.

3.03 CONSTRUCTION TOLERANCES

A. Comply with construction tolerances of referenced unit masonry standard.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

B. Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4- inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below, except where indicated otherwise on the Drawings.

D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

E. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.

F. Built-In Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

3. Fill cores in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.05 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.

2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

3. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

B. Lay brick masonry units as follows:

1. Lay brick dry, plumb, level, and true to line in full beds of mortar and with full head joints.

2. After mortar has stiffened somewhat, firmly compact joint with concave jointing tool.

C. Cut joints flush for masonry walls to be concealed or to be covered by other materials. All exposed joints to be tooled with a round jointer. Compact mortar into joints before tooling or striking flush.

3.06 MASONRY WALL INSULATION

A. Insulation inserts shall be placed in all exterior cells and shall be installed in interior cells that are not filled with grout and rebar as the wall is laid up (each course).

B. Interior inserts shall overlap from block-to-block at each course of block.

3.07 HORIZONTAL JOINT REINFORCEMENT

A. General: Provide continuous horizontal joint reinforcement in the joint above the first course and every second course thereafter to the top of the wall. In addition, place continuous horizontal joint reinforcement in the first two joints above lintels and below sills, extending 2 feet each way beyond opening.

B. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing a minimum of 6 inches.

C. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

D. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.08 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.

2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.09 MOVEMENT (CONTROL AND EXPANSION) JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

1. Fit bond breaker strips into hollow contour in ends of block units on one side of control joint. Fill the resultant core with grout and rake joints in exposed faces.

2. Install preformed control joint gaskets designed to fit standard sash block.

3. Install special shapes designed for control joints. Install bond breaker strips at joint. Keep head joints free and clear of mortar or rake joint.

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and wherever openings of more than 1'-0" for brick size units and 2'-0" for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.

1. For hollow concrete masonry unit walls, use specially formed bond beam units with reinforcement bars placed as indicated and filled with coarse grout.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 INSTALLATION OF REINFORCED INSULATED CONCRETE UNIT MASONRY

A. General: Install reinforced unit masonry to comply with requirements of referenced unit masonry standard.

B. Temporary Formwork: Construct formwork and shores to support reinforced masonry elements during construction per ACI 530.

1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

C. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

D. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

E. Grout pour height shall be as given in Table 4.3.3.4 of ACI 530.1/ASCE 6/TMS 602. Place grout lifts not exceeding 5 feet.

F. Consolidate grout at time of placement as follows:

1. Consolidate grout pours exceeding 12 inches by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

2. Consolidate grout pours 12 inches or less in height by mechanical vibration or by puddling.

G. Place reinforcing bars of size and spacing indicated on Drawings, and one (1) #4 full height each side of masonry openings and control joints as follows:

1. Locate bars at center of cells or insulated concrete unit masonry interior cells at spacing and locations shown on Drawings and secure against displacement prior to grouting by wire bar positioners.

2. Place all reinforcing prior to grouting.

3. Unless noted otherwise, where splices are required for reinforcing bars the bars should be lap spliced with minimum laps as follows:

a. #3 Bars: 18 inches.

b. #4 Bars: 24 inches.

c. #5 Bars: 32 inches.

d. #6 Bars: 40 inches.

e. #7 Bars: 42 inches.

4. All lap splices must be wire tied or held in place with fabricated connectors prior to grouting.

5. Reinforcing bars and grout must be placed in such manner that required lap splices can be achieved the following work day.

3.12 FIELD QUALITY CONTROL

A. Testing Frequency: Tests and evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.

1. Mortar properties will be tested per property specification of ASTM C270.

2. Mortar composition and properties will be evaluated per ASTM C780.

3. Grout compressive strength will be sampled and tested per ASTM C1019.

B. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength

C. Evaluation of Quality Control Tests: In absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality control tests comply with minimum requirements indicated.

D. Contractor shall engage certified testing agency to complete all testing of mortar and grout. All costs associated with testing shall be included in Contractor's Base Bid.

E. Results from tests and inspections will be reported promptly and in writing to Owner, Engineer, and Contractor.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Brush exposed masonry clean as the work progresses using paddles and stiff fiber brushes with clean water. Remove excess mortar, spills, etc. before mortar sets.

C. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test Cleaning Methods on Sample Wall Panel: Leave 1/2 panel uncleaned for comparison purposes. Obtain Owner's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

   Clean brick by means of bucket and brush hand-cleaning method described in BIA "Technical Note No. 20 Revised" using the following masonry cleaner:

   a. Job-mixed detergent solution.

   b. Proprietary Acidic Cleaner: Apply in compliance with directions of acidic cleaner manufacturer.

E. Clean concrete masonry by means of cleaning method indicated in NCMA TEK 45 applicable to type of stain present on exposed surfaces.

F. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

END OF SECTION

METALS

DIVISION 5

TABLE OF CONTENTS

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PART 1 - GENERAL

1.01 SUMMARY

A. The work includes the following metal fabrications:
1. Rough hardware.
2. Nosings.
3. Loose bearing and leveling plates.
4. Loose steel lintels.
5. Applications where framing and supports are not specified in other Sections.
6. Miscellaneous steel trim.
7. Metal stairs.

1.02 RELATED SECTIONS

A. SECTION 03 30 00 – “Concrete”

B. SECTION 05 12 00 – “Structural Steel”

C. SECTION 03 60 00 – “Grout”

D. SECTION 09 96 00 – “High Performance Coatings”

1.03 DEFINITIONS

A. Definitions in ASTM E985 for railing-related terms apply to this Section.

1.04 SUBMITTALS

A. Submit under provision of Section 01 33 00.

B. Product data for products used in miscellaneous metal fabrications, including paint products and grout.

C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections . Show anchorage and accessory items . Provide templates for anchors and bolts specified for installation under other Sections.

D. Samples representative of materials and finished products as may be requested by Engineer.

E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article.

F. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience . Include list of completed projects with project name, addresses, names of Engineer's and Owner's, and other information specified.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Firms experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Installer Qualifications: Arrange for installation of metal fabrications specified in this Section by same firm that fabricated them.

C. Qualify welding processes and welding operators in accordance with AWS guidelines. Certify that each welder has satisfactorily passed AWS qualification tests for the specific welding processes involved and, if pertinent, has undergone recertification in the following areas.
1. D1.1 "Structural Welding Code – Steel."
2. D1.2 "Structural Welding Code - Aluminum."
3. D1.3 "Structural Welding Code - Sheet Steel."
4. D1.6 “Structural Welding Code – Stainless Steel.”
5. D18.1 “Process Piping & Tubing – Stainless Steel.”

1.06 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings . Coordinate fabrication schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.01 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes . Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. Structural Steel: ASTM A36.

C. Steel Plates: ASTM A36 or A572.

D. Rolled Steel Floor Plates: ASTM A786 with tensile strength per ASTM A36 or ASTM A572.

E. Steel Bars for Gratings: ASTM A569, hot-dip galvanized coating in accordance with ASTM A123 after fabrication.

F. Wire Rod for Grating Cross Bars: ASTM A510.

G. Steel Tubing: Hot-formed steel tubing ASTM A501, Hot-dip galvanized coating in accordance with ASTM A123.

H. Uncoated Structural Steel Sheets and Strips: Hot-rolled structural steel sheet per ASTM A570, Grade 30, unless otherwise indicated or required by design loading.

I. Galvanized Steel Sheet: Structural Quality per ASTM A924; Grade A, unless another grade required for design loading, and G90 coating designation per ASTM A653 unless otherwise indicated.

J. Steel Pipe for Posts and Rails: ASTM A501, ASTM A500, or ASTM A53; finish, type, and weight class as follows:
1. Shop prime coat, zinc chromate alkyd, federal specifications TT-P-645.
2. Galvanized finish for exterior installations.
3. Type S, Grade B, Schedule 40, except hydrostatic test is not required.

K. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

L. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27 . Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A153.

2.02 STAINLESS STEEL:

A. Bar Stock and Rounds: ASTM A276, Type 302 or 304.

B. Plate and Sheet: ASTM A167, Type 302 or 304.

C. Fittings, attachments, and accessories shall conform to ASTM A167, ASTM A743 (cast); or (forged).

D. Structural Shapes: ASTM Type 304.

E. Finish shall be AISI No. 4, polished and fabricated in accordance with 3-A Sanitary Standards (3A-Dairy) . Mill finish on structural shapes is acceptable provided scratches and any welded joints are ground smooth and polished to match adjacent mill finish.

2.03 ALUMINUM

A. Extruded Bars and Shapes: ASTM B221, alloys as follows:
1. 6061-T6 or 6063-T6 for bearing bars of gratings and shapes.
2. 6063-T5 for grating cross bars.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B632, alloys as follows:
1. 6061-T6 for platforms.
2. 6061-T4 for treads.

C. Fittings, attachments, and accessories shall conform to ASTM B209 (flat stock), ASTM B26 (cast), or ASTM B247 (forged).

D. Finish shall be clear anodized.

2.04 FASTENERS

A. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls . Select fasteners for the type, grade, and class required.

B. Structural Bolts and Nuts: Regular hexagon head type, ASTM A325, Grade A.

C. Anchor Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A.
1. Lag Bolts: Square head type, FS FF-B-561.

D. Machine Screws: Cadmium plated steel, FS FF-S-92.

E. Wood Screws: Flat head carbon steel, FS FF-S-111.

F. Plain Washers: Round, carbon steel, FS FF-W-92.

G. Drilled-In Expansion Anchors: Expansion anchors complying with FS FF-S-325, Group VIII (anchors, expansion, [nondrilling]), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.

H. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

I. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

2.05 PAINT

A. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with MIL-P-21035 or SSPC-Paint-20.

B. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

2.06 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated . Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support . Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
1. Allow for thermal movement resulting from the following maximum change in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners . Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
2. Temperature Change: 100 deg F.

C. Shear and punch metals cleanly and accurately . Remove burrs.

D. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated . Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Remove sharp or rough areas on exposed traffic surfaces.

F. Weld corners and seams continuously to comply with AWS recommendations and the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

G. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible . Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head countersunk screws or bolts . Locate joints where least conspicuous.

I. Provide for anchorage of type indicated; coordinate with supporting structure . Fabricate and space anchoring devices to provide adequate support for intended use.

J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly . Disassemble units only as necessary for shipping and handling limitations . Use connections that maintain structural value of joined pieces . Clearly mark units for reassembly and coordinated installation.

K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.07 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures . Straight bolts and other stock rough hardware items are specified in Division 6 Sections.

B. Fabricate items to sizes, shapes, and dimensions required . Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.08 NOSINGS:

A. Nosings for Interior Cast-in-Place Concrete Treads: Two inches wide by not less than 3/8 inch thick cast extruded aluminum alloy 6063-T5 or T6, having two (2) rows of integrally cast extruded anchors and epoxy/abrasive filler of aluminum oxide in color(s) as selected by ENGINEER.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. "Spectra Type WP2C"; Wooster Products, Inc.
      b. "Sure-Step Type FA-211"; American Safety Tread Company, Inc.
      c. "Amstep Series 100-DSA-2"; American Safety Technologies, Inc.

2.09 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area . Drill plates to receive anchor bolts and for grouting as required . Galvanize after fabrication.

2.10 LOOSE STEEL LINTELS

A. Provide loose structural steel lintels from steel angles and shapes, of size indicated, for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels for equal bearing of one inch per foot of clear span but not less than 8 inches bearing at each side of openings, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.11 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports . Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection . Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Equip units with integrally welded anchors for casting into concrete or building into masonry . Furnish inserts if units must be installed after concrete is placed.
      a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long.

C. Galvanize miscellaneous framing and supports.

2.12 MISCELLANEOUS STEEL TRIM

A. Provide shapes and sizes indicated for profiles shown . Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges . Use concealed field splices wherever possible . Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

B. Galvanize miscellaneous framing and supports.

2.13 STEEL AND ALUMINUM FRAMED STAIRS

A. General: Construct stairs to conform to sizes and arrangements indicated . Join pieces together by welding, unless otherwise indicated . Provide complete stair assemblies, including metal framing, hangers, columns, railings, newels, balusters, struts, clips, brackets, bearing plates, and other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual" for class of stair designated, except where more stringent requirements are indicated:
   1. Commercial Class, unless otherwise indicated.
   2. Architectural Class where indicated.
   3. Industrial Class where indicated.
   4. Service Class where indicated.
   5. Fabricate treads and platforms of exterior stairs to accommodate slopes to drain in finished traffic surfaces.

C. Stair Framing: Fabricate stringers of structural steel channels, or plates, or a combination thereof, as indicated . Provide closures for exposed ends of stringers . Construct platforms of structural steel channel headers and miscellaneous framing members as indicated . Bolt or weld headers to strings, newels, and framing members to strings and headers; fabricate and join so that bolts, if used, do not appear on finish surfaces.
   1. Where masonry walls support steel stairs, provide temporary supporting struts designed for erection of steel stair components before installation of masonry.

D. Steel Floor Plate Treads and Platforms: Provide raised pattern steel floor plate in pattern indicated or, if not indicated, as selected from manufacturer's standard patterns.

1. Fabricate platforms of raised pattern steel floor plate of thickness indicated . Provide nosing matching that on treads at all landings . Secure to platform framing members with welds.

E. Floor Grating Treads and Platforms: Provide patterns, spacing, and bar sizes indicated; fabricate to comply with NAAMM "Metal Bar Grating Manual."
1. Finish: Shop prime paint.

F. Fabricate grating treads with steel plate nosing on one edge and with steel angle or steel plate carrier at each end for stringer connections . Secure treads to stringers with bolts or saddle clips . Field drill bolt holes in supports.

G. Fabricate grating platforms, with nosing matching that on grating treads, at all landings . Provide toe plates at open-sided edges of grating platform . Secure grating to platform frame with welds or saddle clips . Weld stud bolts to supports.

H. Stair Railings and Handrails: Comply with applicable requirements specified elsewhere in this Section for steel pipe railings and handrails, and as follows:
1. Fabricate newels of steel tubing and provide newel caps of gray-iron castings, as shown.
2. Railings may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.

I. Connect railing posts to stair framing by direct welding, unless otherwise indicated.

2.14 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:
1. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Use Method SP-3 "Power-Tool Cleaning" for exposed steel or otherwise as indicated.
2. Use Method SP-5 "White Metal Blast Cleaning" when totally clean, shiny surface is required.
3. Use Method SP-6 "Commercial Blast Cleaning" for severe conditions of exposure.
4. Use Method SP-7 "Brush-Off Blast Cleaning" for interior exposed steel scheduled to receive other Architectural applications or otherwise as indicated.
5. Use Method SP-10 "Near-White Blast Cleaning" for steel subjected to high humidity, chemical, atmospheric, marine, or other highly corrosive environments.

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated .

Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

1. Paint system for all miscellaneous steel shall be in accordance with Section 09 96 00 “High Performance Coatings.” If not otherwise specifically noted in the Paint Schedule, miscellaneous steel shall be coated per the requirements for Steel Plates and Shapes.
2. Epoxy Primer: Surface prep per SSPC-SP6 followed by 4 mils DFT of zinc rich epoxy equivalent to Con-Lux Zinc Plate Type 2, Carboline 858, International Interzinc 308, or other approved equivalent.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction . Coordinate delivery of such items to project site.

B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.

C. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.02 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications . Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints . Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations . Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.03 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces . Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges, or other adjustable devices . After the bearing members have been positioned and plumbed, tighten the anchor bolts . Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
   1. Use metallic nonshrink grout in concealed locations where not exposed to moisture; use nonmetallic nonshrink grout in exposed locations, unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 INSTALLATION OF STEEL AND ALUMINUM STAIRS

A. Furnish setting drawings, diagrams, templates, and directions for installation of anchorages including concrete inserts, anchor bolts, and miscellaneous items with integral anchors that are to be embedded in concrete construction.

B. Fasten to in-place construction with anchorage devices and fasteners where necessary for securing miscellaneous metal items including threaded fasteners, concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

C. Assemble steel stair components to comply with manufacturer's instructions with each component aligned and in correct relationship to each other, securely anchored to supporting column and adjacent structure.

D. Place stairs in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels . Do not cut, alter, or drill any stair components in field that do not fit properly . Return to manufacturer for connections that are indicated to be bolted or screwed.

E. Weld connections between stairs and building structure indicated . Comply with AWS D1.1 for materials and procedures for manual shielded metal-arc welding, the appearance and quality of welds made, and methods used in correcting welding work.

3.05 ADJUSTING AND CLEANING

A. Touch-Up Painting: Cleaning and touch-up painting of field welds, bolted connections, and abraded areas of the shop paint on miscellaneous metal is specified in Section 09 96 00 “High Performance Coatings” of these Specifications.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

C. Stainless Steel Items: Grind and polish all exposed stainless surfaces per finish specified in Section 2.02 . Remove all sharp corners and edges on exposed plates and shapes to eliminate rough corners and hazards prior to grinding and polishing . Repair any scratched or abraded areas with solvent and wipe all stainless surfaces to achieve a clean surface.

END OF SECTION

SECTION 05 52 13
ALUMINUM PIPE OR TUBE RAILINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work includes all aluminum pipe or tube railings and hand rails, fittings, attachments, and accessories.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Submit shop drawings for all railings, including materials, finishes, and splice and attachment details. Identify locations and the relationship to adjoining work. Indicate all required field measurements.

C. Submit manufacturer's assembly and installation instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Posts and rails shall be aluminum pipe or tube conforming to ASTM B429, alloy 6063 or ASTM B483, alloy 6063.

B. Fittings, attachments, and accessories shall conform to ASTM B209 (flat stock), ASTM B26 (cast), or ASTM B247 (forged).

C. Finish shall be Architectural Class 1, clear anodized per Aluminum Association AA-M12C22A41 per AAMA 607.1.

2.02 FABRICATION

A. Verify field dimensions prior to fabrication.

B. Railing shall be formed by mechanical joints or welded construction conforming to AWS D1.2. All welds shall be ground smooth.

C. Rail-to-end post connections and all changes in rail direction shall be formed by radius bends.

D. Two intermediate equally spaced rails required for commercial and industrial applications. Four intermediate rails equally spaced required for assembly, business, educational and institutional facilities.

E. Close exposed ends of pipe with 3/16 inch plate or prefabricated fittings.

F. Provide weep hole where moisture may accumulate.

G. Toe plates shall extend at least 4 inches above walking surface.

H. Slip-fit sleeves shall be provided for removable railings.

I. Where shown, provide chain with eye, snap hook, and staple.

J. Supply components required for proper anchorage of railings and handrails.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Erect work square, level, and free from distortion or defects detrimental to appearance and performance.

B. Tolerances:
1. Spacing: ± 3/8 inch.
2. Alignment: ± 1/4 inch.
3. Plumbness: ± 1/8 inch.

C. Set posts in concrete with non-shrink grout (SECTION'S 03 60 00). Cast ends of aluminum posts set in grout shall be coated with Tnemec series 66 epoxy, 2-4 mils thick.

D. Grind smooth all field welds.

E. Remove weld or other stains in accordance with manufacturer's recommendations.

F. Rectify all defective work.

END OF SECTION

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SECTION 05 53 00
ALUMINUM GRATING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work includes all aluminum grating, including accessories.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Submit shop drawings showing all locations and fabrication dimensions; type, detail, and location of anchorages; and location and detail of all openings greater than 4 inches in any direction.

C. Submit material certifications and product data, if requested.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Bearing bars: Aluminum alloys 6063-T6 or 6061-T6 per ASTM B221.

B. Cross bars: Aluminum alloy 6063-T5, ASTM B221.

2.02 FABRICATION

A. Field verify all dimensions prior to fabrication.

B. Serrated or non-slip grating shall be provided for all exterior applications. Plain grating shall be provided for interior applications, unless otherwise noted on the drawings.

C. Unless otherwise noted on the Drawings, grating shall be of the pressure locked aluminum type with bearing bars spaced at 1-3/16 inches on center and cross bars spaced at 4 inches on center.

D. Bearing bar size shall be as noted on the Drawings or, where not shown, shall be designed for a 150 psf uniform live load or a maximum 1/4 inch deflection at mid-span for a 400 pound concentrated load, whichever controls. Minimum grating depth shall be 1 inch.

E. Openings shall be placed in accordance with approved shop drawings. Contractor shall coordinate the location and size of all openings with the various trades.

F. All grating shall be banded.

G. All grating shall have a standard mill finish.

PART 3 - EXECUTION

3.01 INSPECTION

A. Check supporting members for correct layout and alignment.

B. Verify that surfaces to receive metal grating are free of debris.

C. Do not proceed with installation until defects are corrected.

3.02 INSTALLATION

A. Install metal grating units and accessories in accordance with manufacturer's recommendations and approved shop drawings.

B. Placing Metal Grating Units

1. Position on supports and adjust to final position with ends bearing on supporting members and accurately aligned before being permanently fastened.

2. Place grating units flat and square, and secure to adjacent support without warp or deflection.

C. Anchoring Grating Units

1. All grating is to be firmly anchored to supports. Minimum of four (4) locations per panel.

D. Openings with a maximum dimension of 4 inches or less may be cut in the field.

E. Touch-Up Painting

1. Wire brush, clean and paint scarred areas, welds, and rust spots on supporting surfaces.

2. Touch-up galvanized surfaces with galvanized repair paint applied in accordance with manufacturer's instructions.

F. Do not use grating units for storage or working platforms until permanently secured in position.

G. Assure that construction loads do not exceed carrying capacity of grating.

END OF SECTION

WOOD, PLASTICS AND COMPOSITES

DIVISION 6

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the following:
1. Dimension lumber and boards.
2. Treated wood.
3. Rooftop equipment bases and support curbs.
4. Wood grounds, nailers, and blocking.
5. Sheathing, Subflooring, and Underlayment.

1.02 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 – "Submittals."

B. Product data for the following products:
1. Engineered wood products.
2. Underlayment.
3. Insulating sheathing.

C. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use as well as design values approved by the Board of Review of American Lumber Standards Committee.

D. Wood treatment data as follows including chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material:
1. For each type of preservative treated wood product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
2. For water-borne treated products include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.
3. Warranty of chemical treatment manufacturer for each type of treatment.

1.03 QUALITY ASSURANCE

A. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review. Lumber shall meet requirements of ASTM D1165.

B. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:
1. NLGA - National Lumber Grades Authority (Canadian).
2. SPIB - Southern Pine Inspection Bureau.
3. WWPA - Western Wood Products Association.

C. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
1. For exposed lumber furnish pieces with grade stamps applied to ends or back of each piece; or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.

D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
   1. Provide dressed lumber, S4S, unless otherwise indicated.
   2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

E. Single-Source Responsibility for Engineered Wood Products: Obtain each type of engineered wood products from one source from single manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces.

B. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
   1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.01 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: "Standard" grade light framing size lumber of any species or board-size lumber as required. "Standard" grade boards per WWPA rules or "No. 2 Boards" per SPIB rules.

2.02 PLYWOOD PANELS

A. Plywood Panel Standards: Comply with PS 1 "US. Product Standard for Structural Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108.

B. Trademark: Furnish plywood panels that are each factory-marked with APA trademark evidencing compliance with grade requirements.

C. Plywood Backing Panels: For mounting electrical or telephone equipment, provide plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32 inch.

2.03 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with minimum 1.25 oz (G-90) hot-dip zinc coating per ASTM A153 or of AISI Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power Driven Fasteners: National Evaluation Report NER-272.

D. Wood Screws: ANSI B18.6.1.

E. Lag Bolts: ANSI B18.2.1.

F. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and where indicated, flat washers.

2.04 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

A. General: Where lumber or plywood is indicated as preservative-treated wood or is specified herein to be treated, comply with applicable requirements of AWPA Standard U1. Mark treated items with an AWPA Quality Mark on each piece.

B. Pressure-treat wood with water-borne preservatives.

C. Do not use chemicals containing Chromium or Arsenic.

D. For interior uses, after treatment of indicated items, kiln-dry lumber and plywood to maximum moisture content, respectively, of 19 percent and 15 percent.

E. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing shall be treated to the requirements of Use Category 2 (UC2).

1. Treated wood used for roof blocking shall be kiln dried after treatment and shall be stamped KDAT.

F. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete shall be treated to the requirements of Use Category 2 (UC2).

G. Wood floor plates installed over concrete slabs directly in contact with earth shall be treated to the requirements of Use Category 2 (UC2).

H. Exterior wood framing members less than 18 inches above grade shall be treated to the requirements of Use Category 3B (UC3B).

I. Exterior wood framing members 18 inches and greater above grade shall be treated to the requirements of Use Category 3A (UC3A).

J. Wood members in contact with the ground or fresh water shall be treated to the requirements of Use Category 4B (UC4B).

K. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.

E. Countersink nail heads on exposed carpentry work and fill holes.

F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.02 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Install permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inches (38.1 mm) wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

3.03 INSTALLATION OF PLYWOOD PANELS

A. General: Comply with applicable recommendations contained in, "APA E30 Engineered Wood Construction Guide," for types of construction sheathing panels and applications indicated.

B. Fastening Methods: Fasten sheathing panels by nailing to framing.

1. Plywood Backing Panels: Nail to supports.

END OF SECTION

THERMAL AND MOISTURE PROTECTION

DIVISION 7

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SECTION 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes cold-applied water-based emulsified asphalt dampproofing reinforced with short fibers for application by brush or spray.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Product Data: Include data substantiating that materials comply with specified requirements for each dampproofing material specified.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed bituminous dampproofing work similar in material, design, and extent to that indicated for Project and that has resulted in construction with record of successful in-service performance.

B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.04 PROJECT CONDITIONS

A. Substrate: Proceed with dampproofing work only after substrate construction and penetrating work have been completed.

B. Material storage and handling: Store in unopened containers. Do not allow materials to freeze, and do not store below 35 degrees Fahrenheit.

C. Weather: Proceed with dampproofing work only when existing and forecast weather conditions will permit work to be performed in accordance with manufacturer's recommendations. Do not apply during freezing weather.

PART 2 - PRODUCTS

2.01 COLD-APPLIED ASPHALT EMULSION DAMPPROOFING

A. Asphalt Emulsion: Asphalt-and-water-emulsion coating, compounded to penetrate substrate and build to moisture-resistant coating. Provide fibrated-type asbestos-free asphalt emulsion; ASTM D 1227, Type 2, Class 1.

B. Products: Subject to compliance with requirements, provide emulsion products from one of the following:
1. "MasterSeal 615": Master Builders Solutions, BASF.
2. "220 AF Fibered Emulsion"; Karnak Corporation, or equivalent.

2.02 MISCELLANEOUS MATERIALS:

A. Bituminous Grout: Comply with ASTM D147.

B. Plastic Cement: Asphalt based, complying with ASTM D491, except provide coal tar base where specifically recommended by manufacturer of dampproofing materials.

C. Protection Course, Roll Roofing Type: ASTM D6380, Class S, Type III smooth-surfaced roll roofing, weighing not less than 51.1 lb/100 sq. ft.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBSTRATE

A. Cure concrete and perform tightness testing as required by Section 03 30 00 prior to application of dampproofing on concrete substrates.

B. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.

C. Fill voids, seal joints, and apply bond breakers (if any) as recommended by material manufacturer, with particular attention at construction joints.

D. Seal around piping, anchors, or other items that penetrate through the surface to be treated.

E. Prime substrate as recommended by material manufacturer.

F. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work, by masking or otherwise protecting adjoining work.

3.02 INSTALLATION, GENERAL

A. Foundation Wall Dampproofing: Apply dampproofing to all exterior below-grade surfaces of exterior underground walls in contact with earth or other backfill and where space is enclosed on opposite side.

B. Extend vertical dampproofing down walls from just below finished grade line to top of footing, extend over top of footing, and turn down minimum of 6 inches over outside face of footing. Extend 12 inches onto intersecting walls and footings but do not extend onto surfaces that will be exposed to view when project is completed.

3.03 ASPHALT EMULSION ON EXTERIOR SURFACES

A. Complying with manufacturer’s recommendations apply two (2) coats of semi-fibrated, asphalt emulsion dampproofing materials, by brushing or spraying at rate of 30 to 35 sq. ft/gal per coat. Allow first coat to dry per manufacturer’s instructions prior to applying second coat. Coating shall be 1/8” minimum thickness.

3.04 INSTALLATION OF DAMPPROOF PROTECTION

A. Install protection course of type indicated over completed and cured dampproofing treatment. Comply with dampproofing materials manufacturer's recommendations for method of support or attachment of protection materials. Support with spot application of plastic cement where not otherwise indicated.

3.05 BACKFILL

A. Do not place dampproof protection and backfill material until at least 24 hours after application, but within 7 days, or complying with dampproofing materials manufacturer's recommendations. Exercise care when backfill is placed to not disturb the application, or otherwise rupture and damage the coating.

END OF SECTION

SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the following:
1. Foundation wall insulation (supporting backfill).

1.02 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Product data for each type of insulation product specified.

1.03 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.
1. Surface Burning Characteristic: ASTM E84.
2. Fire Resistance Ratings: ASTM E119.
3. Combustion Characteristics: ASTM E136.

B. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

B. Protect plastic insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to project site ahead of installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATING MATERIALS

A. Extruded Polystyrene Board Insulation: Rigid, cellular polystyrene thermal insulation with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C578 for type indicated; with 5-year aged R-value per inch of 5 at 75 deg F. Maximum flame spread and smoke developed values of 10 and 200, respectively.
1. Type VI, 1.8 pcf minimum density and 40 psi minimum compressive strength.

a. Products: Subject to compliance with requirements, provide one of the following:
   1) "Styrofoam Highload 40," DuPont.
   2) "Foamular 404," Owens Corning, or equivalent.

2.02 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation or mechanical anchors securely to substrates indicated without damaging or corroding either insulation, anchors, or substrates.

B. Eave Ventilation Troughs: Preformed rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections that might puncture vapor retarders.

3.03 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

C. Apply single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.04 INSTALLATION OF PERIMETER INSULATION

A. On vertical surfaces, set extruded polystyrene units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive recommended by manufacturer of insulation.

B. Protect below-grade insulation on vertical surfaces (from damage during back-filling).

3.05 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Single-ply membrane roofing systems that utilize single ply roofing membranes including the following:
   1. Totally adhered systems.
   2. Ethylene propylene dien monomer (EPDM)

B. Roof insulation related to flexible sheet roofing.

1.02 RELATED WORK

A. SECTION 06 10 00 – "Rough Carpentry."

1.03 SUBMITTALS

A. Submit under provision of Section 01 33 00 – "Submittals".

B. Product data, installation instructions, and general recommendations from manufacturer of single ply membrane system for types of roofing required. Include data substantiating that materials comply with requirements.
   1. If products will be supplied to the project exactly as specified, the CONTRACTOR may, at his option, submit a letter of certification listing products being supplied and identifying the manufacturer. Provided information is adequate to verify conformance with the specifications, a submittal is not required for product data, installation instructions and general manufacturer recommendations.

C. Samples of finished roofing sheets, including T-shaped side/end-lap seam. Also include the following:
   1. Samples of required insulation.

D. Shop drawings showing roof configuration, sheet layout, seam locations, colors (as applicable), details at perimeter, and special conditions.
   1. Indicate layout of tapered insulation materials.

E. Test data for pullout resistance of fastening systems.

1.04 QUALITY ASSURANCE

A. Manufacturer: Obtain primary flexible sheet roofing from a single manufacturer. Provide secondary materials as recommended by manufacturer of primary materials.

B. Installer: Engage an experienced Installer to apply single ply membrane roofing. Installer must be licensed by the manufacturer of primary roofing material and must have three (3) years minimum experience installing the specified manufacturers product. Submit to the Engineer, if requested, a list of successfully completed installations of the specified product.
   1. Work associated with single ply membrane roofing, including (but not limited to) insulation, flashing and counterflashing, expansion joints, and joint sealers, is to be performed by Installer of this work.

C. Pre-Roofing Conference: Prior to installation of roofing and associated work, meet at project site, or other mutually agreed location, with Installer, roofing sheet manufacturer, installers of related work, and other entities concerned with roofing performance, including (where applicable)

OWNER'S insurer, test agencies, governing authorities, (CONSTRUCTION MANAGER) (ENGINEER), and OWNER. Review project schedule, delivery requirements, unusual project conditions, roof traffic and other issues essential for coordination of the work. Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours' advance notice to participants prior to convening pre-roofing conference.

D. UL Listing: Provide labeled materials that have been tested and listed by UL in "Building Materials Directory" or by other nationally recognized testing laboratory for application indicated, with "Class A" rated materials/system for roof slopes shown.

E. Insulated Roof Assembly Ratings: Roof assemblies which do not have thermal barrier separation between metal deck and foam plastic insulation shall have successfully passed ANSI/UL 1256 and FM 4450 Calorimeter test procedures.

1.05 PROJECT CONDITIONS

A. Weather Conditions: Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturers' recommendations and warranty requirements.

B. Substrate Conditions: Do not begin roofing installation until substrates have been inspected and are determined to be in satisfactory condition.

C. Comply with requirements of NFPA 241 during installation of roofing.

1.06 WARRANTY

A. Manufacturer's Warranty: Submit executed copy of single ply membrane manufacturer's "Limited Service Warranty" agreement including flashing endorsement, signed by an authorized representative of manufacturer. Provide form that was published with product literature as of date of Contract Documents, for the following period of time:

B. Special Project Warranty: Submit two executed copies of manufacturer’s "Roofing Warranty" on form included at end of this Section, covering work of this Section including roofing membrane, composition flashing, roof insulation, and roof accessories, signed and countersigned by Installer (Roofer) and Contractor.
1. 10 years after date of Substantial Completion.
2. 15 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL

A. Compatibility: Provide products that are recommended by manufacturers to be fully compatible with indicated substrates, or provide separation materials as required to eliminate contact between incompatible materials.

2.02 EPDM MEMBRANE

A. General: Ethylene propylene diene monomers formed into uniform, flexible sheets, complying with ASTM D4637, Type 1.
1. Class SR, Scrim or fabric internal reinforced.
2. Thickness: 60 mils, nominal.
3. Exposed Face Color: Black.

B. Method of Installation: Comply with NRCA Roofing and Waterproofing Manual, Specification Plate (46-1, IESL) (46-2, IESP) (46-3, IESF).
   1. Loose laid and ballasted EPDM membrane (46-1, IESL).
   2. Mechanically fastened EPDM membrane(46-2, IESP).
   3. Fully adhered EPDM membrane(46-3, IESF).

C. Manufacturers subject to compliance with requirements of this Section, provide products of one of the following:
   1. Carlisle Syntec Systems.
   2. Firestone Building Products Co.
   3. Engineer approved equal.

2.03 AUXILIARY MATERIALS

A. Gypsum Board Base: ASTM C79, Type X, waterproof sheathing, 5/8 inch thick.

B. Sheet Seaming System: Manufacturer's standard materials for sealing lapped joints, including edge sealer to cover exposed spliced edges as recommended by membrane manufacturer.

C. Tapered Edge Strips, and Flashing Accessories: Types recommended by membrane manufacturer, including adhesive tapes, flashing cements, and sealants.

D. Flashing Material: Manufacturer's standard system compatible with flexible sheet membrane.
   1. Wood Nailers: Pressure Treated lumber or plywood complying with applicable requirements of AWPA Standard U1. Mark each treated item with the AWPA Quality Mark requirements.
   2. Pressure treat wood nailers with water-borne preservatives to the requirements of use category 2 (UC2). For interior uses after treatment, kiln dry lumber and plywood to maximum moisture content of 19 percent and 15 percent respectively. Nailers shall be stamped KDAT (kiln dried after treatment).
   3. Do all cutting and fabricating of treated items prior to treatment where possible. If cut after treatment, coat surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

E. Walkway Protection
   1. Rubber Walkway Pads: Rubber pad made by or approved by the roof system manufacturer, such as:
      a. Carlisle “Roof Walkway Pad”, molded or shredded, 30” by 30”.
      b. Firestone “Quick Seam Walkway pads.”

F. Slip Sheet: Type recommended by membrane manufacturer for protecting membrane from incompatible substrates.

G. Mechanical Fasteners: Metal plates, caps, battens, accessory components, fastening devices, and adhesives to suit substrate and as recommended by membrane manufacturer.

H. Membrane Adhesive: As recommended by membrane manufacturer for particular substrate and project conditions, formulated to withstand min. 60-psf uplift force.

2.04 INSULATING MATERIALS

A. General: Provide insulating materials to comply with requirements indicated for materials and in compliance with referenced standards in sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths. Furnish thicknesses indicated on Drawings.

1. Provide tapered board where indicated for sloping to drain. Fabricate with taper of 1/4 inch per foot, minimum, unless otherwise indicated.

B. Polyisocyanurate Board Roof Insulation: Rigid, cellular thermal insulation with polyisocyanurate closed-cell foam core and manufacturer's standard facing laminated to both sides; complying with ASTM C1289 Type II, Class1.
1. Products: Subject to compliance with requirements, provide “ISO 95+ GL Insulation”, Firestone Building Products Co., or equivalent.

2.05 AUXILIARY INSULATION MATERIALS

A. Adhesive for Bonding Insulation: Type recommended by insulation manufacturer and complying with fire resistance requirements.

B. Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints and filling voids.

C. Mechanical Anchors: Factory mutual approved, Corrosion-resistant type as recommended by insulation manufacturer for deck type and complying with fire and insurance uplift rating requirements.

D. Provide system tested and approved for I-60 wind uplift rating.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBSTRATE

A. General: Comply with manufacturers' instructions for preparation of substrate to receive single ply membrane system.
1. Verify that penetrations, expansion joints, and blocking are in placed and secured and that roof drains are properly clamped into position.

B. Clean substrate of dust, debris, and other substances detrimental to flexible sheet rubber system work. Remove sharp projections.

C. Install flashings and accessory items as shown, and as recommended by manufacturer if not shown.

D. Prevent compounds from entering and clogging drains and conductors and from spilling or migrating onto surfaces of other work.

3.02 INSULATION INSTALLATION

A. General: Extend insulation full thickness in two layers, or in multiple layers over entire surface to be insulated, cutting and fitting tightly around obstructions. Form cant strips, crickets, saddles, and tapered areas with additional material as shown and as required for proper drainage of membrane.
1. Stagger joints in one direction for each course. For multiple layers, stagger joints in both directions between courses with no gaps, to form a complete thermal envelope.
2. Lay insulation boards in parallel courses with long dimension of board perpendicular to continuous joints in deck and with joints in each course staggered with those of preceding course. Adjoining edges shall be brought to moderate contact, but not forced into place.
3. Assure that edges of insulation board are supported minimum of 1-1/2 inches on top flange of metal deck and not over ribs in accordance with Factory Mutual "Loss

Prevention Data Sheet 1-28". Cut neatly around vertical surfaces, cant blocks, vent pipes, and roof curbs.

4. Roof insulation boards, which must be cut to fit roof dimensions, shall be cut so that smallest board dimension is as close to 50 percent of original board size as possible. This may be accomplished by cutting 6-inch sections off certain interior boards. Application shall be in strict compliance with manufacturer's instructions.

B. For unballasted roofing systems, all roof insulation must be totally mechanically fastened down to metal deck in addition to prescribed membrane fastening requirements. Each 4-foot by 8-foot insulation board must have one screw and plate fastener not less than 6 inches from each corner with additional fasteners distributed throughout field of board in pattern as approved by F.M.

C. Do not install more insulation each day than can be covered with membrane before end of day or before start of inclement weather.

3.03 MEMBRANE INSTALLATION

A. General: Start installation only in presence of manufacturer's technical representative.
1. Cut out and repair membrane defects at end of each day's work.

B. Fully Adhered Membrane: Install membrane by unrolling over prepared substrate, lapping adjoining sheets as recommended by manufacturer. Apply adhesive to surfaces to be bonded and roll into place when adhesive has properly cured. Treat seams with special cement and apply sealant to exposed sheet edges, tapering application as recommended by manufacturer. Install mechanical fasteners, flashings and counterflashings, and accessories at locations and as recommended by manufacturer.
1. For colored EPDM roofing sheet, apply 2 coats of "Hypalon" color coat within 30 days of sheet installation, in accordance with manufacturer's instructions, applying each coat at rate of 100 sq. ft. per gallon.

C. Walkway Protection:
1. Adhere rubber walkway pads to roof membrane using manufacturer’s recommended splicing tape. Space each pad minimum of 1-inch and maximum of 6 inches apart to allow for proper drainage. Follow manufacturer’s instructions for installing walkway pads over field fabricated seams or within 3 inches of lap edges.

3.04 PROTECTION OF ROOFING

A. Upon completion of roofing (including associated work), institute appropriate procedures for surveillance and protection of roofing during remainder of construction period. At end of construction period, or at a time when remaining construction will in no way affect or endanger roofing, make a final inspection of roofing and prepare a written report to OWNER, describing nature and extent of deterioration or damage found.

B. Repair or replace (as required) deteriorated or defective work found at time of final inspection to a condition free of damage and deterioration at time of Substantial Completion and in accordance with requirements of specified warranty.

END OF SECTION

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SECTION 07 62 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Flashing and sheet metal including the following:
1. Metal wall flashing.
2. Miscellaneous sheet metal accessories.

1.02 RELATED SECTIONS

A. SECTION 04 20 00 – "Unit Masonry."

B. SECTION 04 22 19 – "Insulated Concrete Unit Masonry"

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Product data, Flashing, Sheet Metal, and Accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

C. Samples of the following flashing, sheet metal, and accessory items:
1. 8-inch-square samples of specified sheet materials to be exposed as finished surfaces.

D. Shop drawings showing layout, profiles, methods of joining, and anchorages details, including major counterflashings, trim/fascia units, gutters, downspouts, scuppers, and expansion joint systems. Provide layouts at 1/4-inch scale and details at 3-inch scale.

1.04 PROJECT CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

2.01 SHEET METAL FLASHING AND TRIM MATERIALS

A. Prefinished Galvanized Sheeting: "Colorklad" as manufactured by Ryerson; 24 gauge, hot-dipped galvanized steel (G-90) (Commercial Quality, Extra Smooth), primed and finished on face side BASF Fluoroceram full strength Kynar 500 or Hylar 5000 based fluoropolymer coating system of 1 mil (25.4 microns) total dry film thickness (plus or minus) and finished on reverse side with white wash coat of 0.3-0.4 mil (7.62 microns to 10.16 microns) dry film thickness. Color and texture to be selected from manufacturer's standard colors by Owner. Provide plastic strippable film for protection during fabrication and installation. Remove plastic film immediately after installation to avoid possible damage to finish coating due to ultraviolet exposure. Provide 20-year warranty in writing, against fading and chalking, and ensuring integrity of color coating.

2.02 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder for use with steel or Copper: Provide 50 – 50 tin/lead solder (ASTM B32), with rosin flux.

B. Solder for use with stainless steel: Provide 60 – 40 tin/lead solder (ASTM B32), with acid-chloride type flux, except use rosin flux over tinned surfaces.

C. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

D. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

E. Paper Slip Sheet: 5-lb. rosin-sized building paper.

F. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gage required for performance.

G. Roofing Cement: ASTM D2822, asphaltic.

2.03 FABRICATED UNITS

A. General metal fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contract, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual." Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Underlayment: Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.

C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

3.02 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION

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SECTION 07 92 00
JOINT SEALERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes joint sealers for the following locations:

1. Exterior Joints in Vertical Surfaces and Nontraffic Horizontal Surfaces:
   a. Control and expansion joints in cast-in-place concrete.
   b. Control and expansion joints in unit masonry.
   c. Joints of stonework set with mortar including coping and cornices.
   d. Joints between different materials listed above.
   e. Perimeter joints between materials listed above and frames of doors and windows.
   f. Control and expansion joints in ceiling and overhead surfaces.
   g. Other joints as indicated.
2. Exterior Joints in Horizontal Traffic Surfaces:
   a. Control, expansion, and isolation joints in cast-in-place concrete slabs for floors and paving.
   b. Joints between different materials listed above.
   c. Other joints as indicated.
3. Interior Joints in Vertical Surfaces and Horizontal Nontraffic Surfaces:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings where indicated.
   c. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
   d. Perimeter joints of plumbing fixtures.
   e. Other joints as indicated.
4. Interior Joints in Horizontal Traffic Surfaces:
   a. Control and expansion joints in cast-in-place concrete slabs.

B. Other joints as indicated.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Product Data from manufacturers for each joint sealer product required, including instructions for joint preparation and joint sealer application.

C. Samples for verification purposes of each type and color of joint sealer required. Install joint sealer samples in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealers.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this Project.

B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from single manufacturer for each different product required.

C. Federal Standards: Comply with following Federal Specifications.

1. One-component products shall meet requirements of TT-S-00230C.
2. Two-component products shall meet requirements of TT-S-00227E.
3. Silicone products shall meet requirements of TT-S-1543A.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.05 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturers.
2. When joint substrates are wet due to rain, frost, condensation, or other causes.

B. Joint Width Conditions: Do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.

D. Sequence installation of joint sealers to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS

2.01 GENERAL

A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with each another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Owner from manufacturer's standard colors.

2.02 ELASTOMERIC JOINT SEALANTS:

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C920 requirements, including those referenced for Type, Grade, Class, and Uses.
1. Two-Part Water Immersion Polysulfide or Polyurethane Sealant: Type M; Grade NS; Class 12-1/2; Uses T, M, G, A, and, as applicable to joint substrates indicated, O; with history of successful test results, per ASTM C719, and field experience in the sealing of joints immersed intermittently or continuously in water of the same composition as that to which sealant will be exposed after installation.
2. Products: Subject to compliance with requirements, provide one of the following:

a. "Synthacalk GC2+"; Pecora Corp.
b. "Sikaflex-2c"; Sika Corp.
c. "MasterSeal NP 2"; Master Builders Solutions, BASF, or equivalent.

B. One-Part Nonacid-Curing Silicone Sealant: Type S, Grade NS, Class 25, and complying with the following requirements for Uses and additional joint movement capability:
1. Uses T, NT, M, G, A, and, as applicable to joint substrates indicated, O.
2. Additional capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C719, to withstand the following percentage changes in joint width as measured at time of application and remain in compliance with other requirements of ASTM C920 for Uses indicated:
a. 50 percent movement in both extension and compression for total of 100 percent movement.
3. Products: Subject to compliance with requirements, provide one of the following:
a. "Dow Corning 790"; Dow Corning Corp.
b. "864"; Pecora Corp., or equivalent.

C. One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide; intended for sealing interior joints with nonporous substrates and subject to in-service exposure to conditions of high humidity and temperature extremes.
1. Products: Subject to compliance with requirements, provide one of the following:
a. "Dow Corning 786"; Dow Corning Corp.
b. "898"; Pecora Corp., or equivalent.

D. One-Part Non sag Urethane Sealant for Non-Traffic Use: Type S; Grade NS; Class 25; and Uses NT, M, A, and, as applicable to joint substrates indicated, O.
1. Products: Subject to compliance with requirements, provide one of the following:
a. "Dynatrol I"; Pecora Corp.
b. "Sikaflex-1a"; Sika Corp.
c. "Sikaflex-15LM"; Sika Corp.
d. "MasterSeal NP 1"; Master Builders Solutions, BASF, or equivalent.

2.03 LATEX JOINT SEALANTS

A. Acrylic-Emulsion Sealant: Manufacturer's standard, 1 part, non sag, mildew-resistant, acrylic-emulsion sealant complying with ASTM C834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.
1. Products: Subject to compliance with requirements, provide one of the following:
a. “Tremflex 834"; Tremco Inc.
b. "AC-20"; Pecora Corp., or equivalent.

2.04 COMPRESSION SEALS

A. Pre compressed Foam Sealant: Manufacturer's standard preformed, pre compressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with nondrying, water repellent agent; factory-produced in pre compressed sizes and in roll or stick form to fit joint widths indicated and to develop watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:
1. Properties: Permanently elastic, mildew-resistant, non migratory, non staining, compatible with joint substrates and other joint sealers.

2. Impregnating Agent: Manufacturer's standard.
3. Density: Manufacturer's standard.
4. Backing: Pressure sensitive adhesive, factory applied to one side, with protective wrapping.
5. Products: Subject to compliance with requirements, provide one of the following:
   a. "Backerseal"; Emseal Corp.
   b. "Will-Seal 150"; Willseal LLC.
   c. "Sealtite Standard", Schul International Company Inc., or equivalent.

2.05 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type which are non staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, non waxing, non extruding strips of flexible, non gassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
   1. Either open-cell polyurethane foam or closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer, for cold-applied sealants only.

C. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F (-15 deg C). Provide products with low compression set and of size and shape to provide secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.06 MISCELLANEOUS MATERIALS

A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Provide non staining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have detrimental effect on sealant adhesion or in-service performance.

C. Masking Tape: Provide non staining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

2.07 JOINT FILLERS FOR CONCRETE PAVING

A. General: Provide joint fillers of thickness and widths indicated.

B. Bituminous Fiber Joint Filler: Preformed strips of composition below, complying with ASTM D1751:
   1. Asphalt saturated fiberboard.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
   1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers; oil; grease; waterproofing; water repellents; water; surface dirt; and frost.
   2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or combination of these methods to produce clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form release agents from concrete.
   4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile; and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Latex Sealant Installation Standard: Comply with requirements of ASTM C790 for use of latex sealants.

D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
   1. Install sealant backing of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
      a. Do not leave gaps between ends of backing.
      b. Do not stretch, twist, puncture, or tear backing.
      c. Remove absorbent backings which have become wet prior to sealant application and replace with dry material.
   2. Install bond breaker tape between sealants and backing, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.
   3. Install compressible seals serving as sealant backings to comply with requirements indicated above for backing.

E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

F. Tooling of Non sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

G. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

END OF SECTION

OPENINGS

DIVISION 8

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work includes hollow metal doors and frames.

1.02 RELATED WORK

A. SECTION 08 71 00 – "Door Hardware."

B. SECTION 09 96 00 – "High Performance Coatings."

1.03 SUBMITTALS

A. Submit under the provisions of Section 01 33 00 – "Submittals."

B. Shop drawings for hollow metal doors and frames. Indicate profiles, sizes, connections, reinforcing, anchorage, elevations, and types. A schedule shall be included for all doors and frames.

1.04 QUALITY ASSURANCE

A. References:
1. SDI-100: Recommended Specifications - Standard Steel Hollow Metal Doors and Frames of Steel Door Institute.
2. ASTM A366: Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
3. ASTM A653: Zinc-coated carbon steel sheets, commercial quality or drawing quality.
4. NFPA 80: Standard for Fire Doors and Fire Windows.
5. NFPA 252: Standard Method of Fire Tests of Door Assemblies.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver items in the manufacturer's cartons or crating.

B. Store off the floor in a dry area of the building out of the way of other work in progress. Provide maximum protection against loss and damage.

C. Handle items in a manner to prevent damage. Marred, defaced, damaged and defective items to be replaced.

1.06 WARRANTY

A. Include standard steel door frame warranty against defects in materials and workmanship for period of one (1) year.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide standard steel doors and frames by one of the following:
1. Standard Steel Doors and Frames:

a. Black Mountain Door
b. Ceco Corp.
c. Curries Company.
d. Pioneer Industries.
e. Ambico Steel Doors, Ltd.

2.02 DOORS

A. Materials and fabrication in accordance with SDI-100 and as herein amended.

B. Interior doors to be Grade II, heavy duty 1-3/4 inch, Model 1, full flush composite construction with no visible seams.

C. Exterior doors to be Grade III, extra heavy duty 1-3/4 inch, Model 1, full flush composite construction with no visible seams

2.03 FRAME FABRICATION

A. Form door frames from 16 gauge steel for interior doors and from 14 gauge steel for exterior doors. Heads and jambs continuously welded and ground smooth for welded frames.

B. Frames for out-swinging exterior doors shall be provided with gutter-type drip edge at head, minimum 16 gauge steel and extending 1 inch beyond door opening, both sides.

C. Provide frames for installation in masonry walls, and drywall. Frame jamb anchors manufacturer's standard to suit conditions with anchors at floor level for all frames.

D. Reinforce frames for hardware, including head frame for surface mounted hardware. Reinforcement shall be per manufacturer’s standard. Provide mortar guard boxes over reinforcement plates welded in place.

E. Rubber silencers (mutes) 3 at lock or latch jambs for door frame openings up to 86 inches; 4 mutes for openings over 86 inches.

F. Provide frame glazing beads for interior glazed openings with hollow metal frames. Frames prepared for beads to receive glass and gaskets specified. Butt beads at corners. Provide snap-on beads.

G. Provide labeled frames as shown.

H. Removable steel spreaders at bottoms of welded door frames to insure parallel alignment.

I. Thoroughly clean surfaces free of foreign contaminants. Surfaces given manufacturer's standard shop coat finish.

2.04 DOOR FABRICATION

A. Interior Doors: Face sheets 18 gauge steel, 1-3/4 inch thick doors with vertical mechanical interlocking seams on stile edges, the door top and bottom shall be internally reinforced by steel members welded to face sheets for Grade II, Model 1 construction.

B. Exterior Doors: Face sheets 16 gauge steel, 1-3/4 inch thick doors with vertical mechanical interlocking seams on stile edges, the door top and bottom shall be internally reinforced by steel

members welded to face sheets for Grade III, Model 1 construction. Tops of exterior doors shall be provided with flush, water and weather tight, top enclosures. Bottoms of out-swinging exterior doors shall be provided with bottom rail drip, minimum 16 gauge steel.

C. Door internal construction to be phenolic resin impregnated Kraft honeycomb core and laminated to inside faces of door.

D. Reinforcement for mortise hardware and surface hardware manufacturer's standard, except 12 gauge steel for surface closers.

E. Double doors shall be provided with a “T” type steel astragal fixed to the interior of the inactive door.

F. Obtain templates for finish hardware.

G. After fabrication, doors shop coat finished same as frames.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install standard door frames in accordance with SDI-100 except as herein amended.

B. Install fire-rated doors and frames with clearances as specified in NFPA 80.

C. Install hollow metal frames plumb and square, in correct locations indicated on drawings and with a maximum diagonal distortion of 1/16 inch. Ensure frames are securely and rigidly anchored to adjacent construction.

D. Install hollow metal doors plumb and square and with maximum diagonal distortion of 1/16 inch. Provide maximum clearance of 1/8 inch at head and 3/16 inch at jamb of doors.

E. After installation, touch up scratched or damaged shop coat surfaces. Use type of primer compatible with shop coat.

F. Paint system and surface preparation for doors and frames shall be in accordance with Section 09 96 00 – “High Performance Coatings.” Primer shall be considered as first coat.

3.02 PROTECTION

A. Final Adjustments: Check and readjust operating hardware items, leaving steel door frames undamaged and in complete and proper operating condition.

B. Protect frames from damage after installation and during subsequent construction. Damaged work shall be replaced by new work at no additional cost to Owner.

END OF SECTION

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SECTION 08 31 00
ACCESS HATCHES

PART 1 - GENERAL

1.01 SCOPE

Work includes provision and installation of access hatches as shown in the drawings.

The Contractor shall be responsible to coordinate all details of the installation of specified equipment with other related parts of the Work.

1.02 SUBMITTALS

A. Submit in accordance with the General and Supplementary Conditions and Section 01 33 00.

B. Submit detailed shop and installation drawings to the Engineer for review.

1.03 Warranty

A. The manufacturer shall guarantee against all defects in materials and/or workmanship for a period of five years.

PART 2 - PRODUCTS

2.01 ACCESS HATCHES

Access hatches with safety grates shall be installed as shown on the plans and meet the requirements as specified herein. Acceptable manufacturers will be Bilco Company, Flygt/EJ Safe Hatch or Engineer approved equal.

Access hatches shall include an aluminum safety grate system below the door leaves and shall be capable to withstand a live load of 300 psf. Hatch leaves shall be ¼" aluminum diamond pattern. The frame shall be extruded aluminum angle with a continuous 1 ½" anchor flange around the perimeter. Exterior of frame that comes in contact with concrete shall be coated with 4 to 6 mils of Tnemec Series 66, or Engineer Approved Equal.

Hatches shall be equipped with heavy 316 stainless steel hinges, Type 316 stainless steel pins, and an automatic hold-open arm with release handle. A slam lock with removable handle and a threaded aluminum keyway plug and locking hasp shall be provided. Hatches shall have a debris gasket to prevent intrusion of debris into the frame. Provide heavy duty cover to cover chain for both sides, if applicable. Hardware shall be zinc plated and chromate sealed. A recessed padlock shall be provided. All hardware shall be 316 stainless steel.

PART 3 - EXECUTION

3.01 GENERAL

Installation shall be performed per the manufacturer's instructions. The manufacturer shall guarantee against all defects in materials and/or workmanship for a period of five years.

END OF SECTION 08 31 00

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SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work includes overhead coiling doors.

1.02 RELATED WORK:

A. SECTION 08 71 00 – "Door Hardware"

1.03 SUBMITTALS:

A. Submit under the provisions of Section 01 33 00, "Submittals."
B. Shop drawings for overhead coiling doors. Indicate profiles, sizes, connections, reinforcing, anchorage, elevations, and types. A schedule shall be included for all doors.
C. Preparation instructions and recommendations.
D. Details of framing members, anchoring methods, required clearances, hardware, and accessories.

1.04 QUALITY ASSURANCE:

A. References:

1. ANSI/DASMA 102 - American National Standards Institute Specifications for Sectional Doors published by Door & Access Systems Manufacturers Association International.

2. ANSI/DASMA 203 - American National Standards Institute Specifications for non-rated fire rolling doors published by Door & Access Systems Manufacturers Association International.

3. ASTM A 123 - Zinc hot-dipped galvanized coatings on iron and steel products.

4. ASTM A 229 - Steel wire, oil-tempered for mechanical springs.

5. ASTM A 653 - Steel sheet, zinc-coated galvanized by the hot-dipped process, commercial quality.

6. ASTM E 330 - Structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference.

7. ASTM E 413 - Classification for Rating Sound Insulation

B. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

C. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and a manufacturer authorized installer.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver items in the manufacturer's cartons or crating.

B. Store off the floor in a dry area of the building out of the way of other work in progress. Provide maximum protection against loss and damage.

C. Handle items in a manner to prevent damage. Marred, defaced, damaged and defective items to be replaced.

1.06 WARRANTY:

A. Provide Rolling Steel Service doors with limited 2 Year Warranty on defects in materials and workmanship on the door.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide ThermoTite Model 800C aluminum overhead coiling door by Wayne Dalton, or Engineer Approved Equal.

2.02 INSULATED ROLLING STEEL SERVICE DOORS:

A. Windload Rated 20 pounds per square foot.

B. ASTM E 413 Sound transmission class acoustical performance value = STC 22.

C. Curtain: composed of interlocking roll formed slats.
1. No. 14 Flat-faced slat. The area between the #14 exterior slat and the back slat filled with polyurethane insulation, R-value of 7.7 (U = 0.13)., 16-gauge aluminum with 24-gauge aluminum back.
2. Ends of alternate slats fitted with metal endlocks/windlocks.

D. Bottom Bar: consists of two equal angles, 0.12 inch minimum thickness, to stiffen curtain, with astragal. Angle shall be aluminum.

E. Guides: Roll-formed steel channel bolted to three structural angle guide angle assembly forming a slot to retain curtains in guides. Structural grade, three angle assembly fabricated of aluminum. Provide with ingegral windlock bars and removal bottom bar stops.

F. Brackets: Design to enclose ends of coil and provide support for counterbalance pipe at each end. Fabricate of steel plates, with permanently sealed ball bearings. Thickness shall be 3/16-inch minimum.

G. Counterbalance: Curtain to be coiled on a pipe of sufficient size to carry door load with deflection not to exceed 0.033 inch per foot of door span. Curtain to be correctly balanced by helical springs, oil tempered torsion type. Cast iron barrel plugs will be used to anchor springs to tension shaft and pipe.

H. Hood: Hood shall be provided to enclose curtain coil and counterbalance mechanism. Hood shall be fabricated of sheet metal, flanged at top for attachment to header and flanged at bottom to provide longitudinal stiffness. Fabricate of minmum 22 gauge B&S aluminum.

I. Finish: Shop coat of rust inhibitive primer on non-galvanized surfaces and operating mechanisms. Guides and bracket plates will be coated with a flat black prime paint.

1. Galvanized Steel Finish Coat shall be a powdercoat finish as selected by Owner from manufacturer's color selections.
2. Aluminum Finish shall be medium bronze anodized.
3. Stainless Steel finish shall be #4 finish.

J. Operation: Door operation shall be by a bracket mounted motor operator with electrical sensing edge attached to bottom bar to stop and reverse door when it contacts an object during the closing cycle.

K. Weatherstripping: Doors shall include bottom astragal, optional surface guide weatherstrip, and internal hood baffle. Provide with lintel brush weatherstrip.

L. Locking shall be interior slide-bolts suitable for padlocks.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Do not begin installation until substrates have been properly prepared.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

3.02 PREPARATION:

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION:

A. Install in accordance with manufacturer's instructions.

B. Install door complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturers instructions, and as specified herein.

C. Fit, align and adjust rolling door assemblies level and plumb for smooth operation.

D. Upon completion of final installation, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting for entire perimeter.

3.04 ADJUSTING:

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.05 CLEANING AND PROTECTION:

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

D. Protect installed products until completion of project.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work includes finish hardware and accessories. For fiberglass doors and frames all hardware and accessories shall be installed by the fiberglass door and frame manufacturer to the greatest extent possible.

1.02 RELATED WORK

A. SECTION 08 11 13 – "Hollow Metal Doors and Frames."

1.03 REFERENCES

A. Builders Hardware Manufacturers Association (BHMA).

B. Door and Hardware Institute (DHI).

C. Steel Door Institute (SDI).

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Hardware Schedules shall be typed vertical hardware schedule including miscellaneous items. Give openings according to Engineer's door locations, manufacturers' names, catalog numbers, keying information, materials, and finish in the scheduling sequence and format as recommended by the Door and Hardware Institute.

C. Catalog cuts included with the Schedule to be of each type of hardware item used.

D. The Owner may request samples showing function, finish, and design of hardware items.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver items in the manufacturer's original package with necessary screws, bolts and installation instructions. Each item individually packaged and carefully marked for the intended opening and use.

B. Store hardware off the floor in a dry area of the building out of the way of other work in progress. Provide maximum protection against loss and damage.

C. Handle items in a manner to prevent damage. Marred, defaced, damaged and defective items will be rejected.

1.06 WARRANTY

A. Door closers shall carry a 25 year limited warranty against defects in materials, workmanship and operation from date of acceptance of building.

B. Locks shall carry a 10 year limited warranty against defects in materials, workmanship and operation from date of acceptance of building.

C. Exit Devices shall carry a 10 year limited warranty against defects in materials, workmanship and operation from date of acceptance of building.

D. Damage or faulty operation due to abuse, improper usage, improper installation, or failure to exercise normal maintenance shall be the responsibility of the Contractor prior to "Substantial Completion" of the project and thereafter the responsibility of the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Hardware items shall be products exactly as specified or equivalent products of approved manufacturers noted in this Specification. Products of other manufacturers will be considered if submitted in writing at least fifteen (15) days prior to the bid date.

2.02 HINGES

A. Hinges shall be button tip, five knuckle with stainless steel pins and concealed bearings.

B. Brass or bronze hinge bases with non-removable pins (NRP) on all exterior doors opening out.

C. Provide stainless steel base hinges on all interior doors.

D. McKinney numbers are used in the Schedule. Acceptable manufacturers are Hager Hinge, Lawrence Bros, Ives, PBB and Stanley Hardware.

2.03 MORTISE LOCKSETS, LATCHSETS and EXIT DEVICES

A. Mortise locksets and latchsets to conform with ANSI A156.2 Series 1000, Grade 1 specification.

B. Lock cases of steel with a standardized size of functions available in one size case.

C. Locksets completely reversible with 3/4" throw latchbolt for non-deadbolt functions and 1-inch throw deadbolt and minimum 5/8" throw latchbolt for deadbolt functions.

D. Schlage 9000 series numbers are used in the Schedule. Acceptable manufacturers are Corbin Russwin, Sargent, Yale or Dorma.

E. Lock trim forged or wrought brass or bronze meeting ANSI A156.2 Grade 1 specifications.

F. Schlage 03 Lever Design with 630/US32D Finish is used in the Schedule.

G. Locksets with standard ANSI strikes of template construction.

H. Von Duprin series numbers are used in the Schedule for Exit Devices. Acceptable manufacturers are Corbin Russwin, Sargent, Yale or Dorma.

2.04 DOOR CLOSERS

A. Closers with key valves, adjustable back-check and phillips head sex bolts.

B. Special arms, brackets, shims and spacers provided to suit conditions.

C. Closers to have Hold-Open option.

D. LCN closer numbers used in the Schedule. Acceptable manufacturers are Corbin Russwin , Dorma, Sargent, or Yale equal to LCN listed.

2.05 WALL AND FLOOR STOPS

A. Cast brass or bronze unless otherwise noted.

B. Hardware supplier to coordinate the sill clearance of the door manufacturer with bumper size to provide appropriate type.

C. Ives numbers used in the Schedule. Acceptable manufacturers are Trimco, Glynn Johnson, and Rockwood.

2.06 THRESHOLDS

A. Thresholds equivalent to those listed in the Schedule.

B. Thresholds shall have expansion shield anchors unless otherwise required.

C. National Guards Products numbers used in the schedule. Acceptable manufacturers are Pemko, Reese, and Durable Products.

2.07 WEATHERSTRIP AND DOOR BOTTOMS

A. Weatherstrip equivalent to those listed in the Schedule.

B. National Guard numbers used for weatherstrip and door bottom seal in the Schedule. Acceptable manufacturers are Reese, Durable Products or Zero International.

2.08 FINISHES

A. Hardware shall have brushed chrome, US26D, finish. (BHMA 626 for brass or bronze base and BHMA 652 for steel base.)

B. Door closers to have aluminum sprayed lacquer finish equal to LCN No. 1 (BHMA 689) unless otherwise stated.

2.09 FASTENERS

A. Exposed fasteners to have phillips heads and be finished to match the items fastened.

B. Sex bolts for door closers, exit devices and overhead holders are thru bolts with grommet or ceal nuts.

2.10 KEYING

A. Cylinders master keyed to existing key system as directed by the Owner.

B. Final change keys and master keys delivered to the Owner.

C. Keys with visual key control. Key bow stamped with the proper key set symbol.

D. Provide temporary cylinders during construction.

E. Provide the following cut keys: Master Keys - 5 each; Change Keys - minimum of 5 and maximum of 20 per key set.

2.11 TEMPLATES

A. Furnish templates to the manufacturers of doors and frames as required for proper reinforcement and preparation of their work.

B. When required, the hardware supplier will furnish the physical hardware to the door and frames manufacturer for application.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mounting heights stated below are center line heights in inches up from the floor. Where heights are not listed, mount in accord with recommendations of D.H.I.

	PART 4 - Hardware Item	Height to Centerline
1.	Bottom hinge	10”-13”
2.	Top Hinge	6”-8” down from head
3.	Intermediate hinge	Equally spaced
4.	Door Knob, wall bumper	38” to 42”
5.	Panic device crossbar	37” to 41”
6.	Cylinder deadlock	60”
7.	Holder	76”

A. Install each hardware item according to the manufacturer’s instructions. Fit hardware accurately and properly. Remove exposed parts until after painter's finishing is completed, then reinstall. Fit faces of mortised parts snug and flush. Make sure operating parts move freely and smoothly without binding, sticking, or excessive clearance.

B. Install door closers to allow the maximum degree of opening without the door or hardware causing interference or damage to the door or trim.

C. Install thresholds in one continuous piece, full width of opening. Set in full bed of mastic and fasten with countersunk anchors.

4.02 FIELD QUALITY CONTROL

A. Door Closer manufacturers' representatives to check the installation of finish hardware, make final adjustments and submit written report to Owner and Contractor listing any and all discrepancies in the installation and materials found during the inspection.

B. A final check of all hardware items and the installation shall be made by the Owner and the Contractor prior to final acceptance of the building by the Owner.

C. Where hardware is found defective in materials or installation, rework, restore, or replace with new.
1. Defective Materials: Unauthorized substitutions; items delivered with missing, broken, damaged or defaced parts; items of incorrect hand or function.
2. Defective Installation: Items broken, damaged, or defaced after delivery; items incomplete, misaligned, or incorrectly located.

4.03 ADJUSTING AND CLEANING

A. After work has been otherwise completed, examine all hardware items for complete and proper installation. Lubricate bearing surfaces of moving parts. Adjust latching and holding devices to proper function.

B. Adjust door control devices to proper speed and power.

C. Clean all exposed surfaces, check for surface damage.

HARDWARE SCHEDULE

HARDWARE GROUP 1 (Single exterior door with Rim exit device)

1.5 Pr	Butts	TA 2314 (4.5 x 4.5 NRP)	US32D
1 Ea	Exit Device	98NL	US32D
1 Ea	Closer	4050 HEDA	AL
1 Set	Weatherseal	160S	AL
1 Ea	Door Sweep	A605A	AL
1 Ea	Threshold	425	AL
1 Ea	Door Stop	1209	AL

HARDWARE GROUP 2 (Double door with astragal and mortise exit device)

3 Pr	Butts	TA 2314 (4.5 x 4.5 NRP)	US32D
1 Ea	Exit device	9975NL	US32D
2 Ea	Flush Bolts	555	32D
2 Ea	Closer	4050 HEDA	AL
1 Ea	Astragal	By door manufacturer	
1 Sets	Weatherseal	160S	AL
2 Ea	Door Sweep	A605A	AL
1 Ea	Threshold	425	AL
2 Ea	Door Stop	1209	AL

HARDWARE GROUP 3 (Single interior door with passage latch)

1.5 Pr	Butts	TA 2314 (4.5 x 4.5 NRP)	US32D
1 Ea	Privacy	9010 x LO3	US32D
1 Ea	Closer	4050 HEDA	AL
1 Set	Weatherseal	160S	AL
1 Ea	Door Sweep	A605A	AL
1 Ea	Threshold	425	AL
1 Ea	Door Stop	1209	AL

END OF SECTION

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FINISHES

DIVISION 9

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PART 1 - GENERAL

1.01 SUMMARY

A. This section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
   1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
   2. Coatings in this specification include shop and field applications. Contractor is responsible for complying with State of Michigan environmental coating compliance standards and volatile organic (VOC) regulations for shop and field applications of coatings. The State of Michigan has adopted Ozone Transport Commission Phase II Model Rule for Architectural and Industrial Maintenance (AIM) coatings.

B. Paint all exposed surfaces except surfaces or items that are specifically indicated not to be painted or to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Engineer will select from standard colors or finishes available.

C. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, and labels unless otherwise noted.
   1. Pre-finished items not to be painted include the following factory-finished components, but not limited to:
      a. Acoustic materials.
      b. Architectural woodwork and casework.
      c. Finished mechanical and electrical equipment.
      d. Light fixtures.
      e. Distribution cabinets.
   2. Concealed surfaces not to be painted include wall or ceiling surfaces in the following generally inaccessible areas:
      a. Foundation spaces.
      b. Furred areas.
      c. Utility tunnels.
      d. Pipe spaces.
      e. Duct shafts.
   3. Finished metal surfaces not to be painted include unless otherwise noted:
      a. Anodized aluminum.
      b. Stainless steel.
      c. Chromium plate.
      d. Copper.
      e. Bronze.
      f. Brass.
   4. Operating parts not to be painted include moving parts of operating equipment such as the following:
      a. Valve and damper operators.
      b. Linkages.
      c. Sensing devices.
      d. Motor and fan shafts.
      e. Hardware
   5. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.02 REFERENCES

A. Reference Organizations and Documents

1. American National Standards Institute (ANSI):
   a. ANSI A13.1 Scheme for the Identification of Piping Systems
   b. ANSI Z535.1 Safety Color Code
   c. ANSI/ASC 29.4 Abrasive Blasting Operations – Ventilation and Safe Practice
2. American Society for Testing Materials (ASTM)
   a. ASTM D 16 Standard Terminology for Paint, Related Coatings, Materials, and Applications.
   b. ASTM D 4285 Standard Test Method for Indicating Water or Oil in Compressed Air.
   c. ASTM D 6386 Standard Practice for Preparation of Galvanized Iron & Steel
   d. ASTM D 6944 Standard Test Method for Measuring Humidity with a Psychrometer.
   e. ASTM F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
3. American Water Works Association (AWWA)
   a. AWWA D102-17 Coating Steel Water Storage Tanks
   b. AWWA C210 Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
   c. AWWA C218 Coating the Exterior of Aboveground Steel Water Pipelines and Fittings
4. International Concrete Repair Institute (ICRI)
   a. 310.2R-2013 Selecting & Specifying Surface Preparation for Sealers, Coatings, Polymer Overlays, & Concrete Repair
   b. 320.1R-1996 Guide for Selecting Application Methods for the Repair of Concrete Surfaces
   c. 710.2-2014 Guide for Horizontal Waterproofing of Traffic Surfaces
5. NACE International (NACE)
   a. NACE 6D-173 A Manual for Painter Safety
   b. NACE 6G-164 Surface Preparation Abrasives for Industrial Maintenance Painting
   c. NACE TPC2 Coating and Lining for Immersion Service: Chapter 1 Safety, Surface Preparation, Chapter 3 Curing, and Chapter 2 Inspection
   d. NACE 6F-163 Surface Preparation of Steel of Concrete Tank Interiors
   e. NACE RP0892 Standard Recommended Practice, Lining over Concrete in Immersion Service.
   f. NACE RP0288 Standard Recommended Practice, Inspection of Linings on Steel and Concrete.
   g. NACE SP0188 Standard Practice for Discontinuity (Holiday) Testing of Protective Linings
6. National Association of Pipe Fabricators (NAPF)
   a. NAPF 500-03 Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings
7. National Fire Protection Association (NFPA)
   a. NFPA 101 Life Safety Code
8. NSF International (NSF)
   a. NSF/ANSI/CAN Standard 61 Drinking Water System Components
   b. NSF/ANSI/CAN Standard 600

9. Ozone Transport Commission (OTC)
   a. OTC Phase II — Phase II Model Rule for Architectural and Industrial Maintenance (AIM) Coatings
10. The Society for Protective Coatings (SSPC)
   a. SSPC-SP 1 — Solvent Cleaning
   b. SSPC-SP 2 — Hand Tool Cleaning
   c. SSPC-SP 3 — Power Tool Cleaning
   d. SSPC-SP 5 — White Metal Blast Cleaning
   e. SSPC-SP 6 — Commercial Blast Cleaning
   f. SSPC-SP 7 — Brush-off Blast Cleaning
   g. SSPC-SP 10 — Near White Metal Blast Cleaning
   h. SSPC-SP 11 — Power Tool Cleaning to Bare Metal
   i. SSPC-SP 13 — Surface Preparation of Concrete
   j. SSPC-SP 16 — Brush-off Blast Cleaning of Non-Ferrous Metals
   k. SSPC-SP WJ-4 — Water Jet Cleaning of Metals
   l. SSPC-PA 1 — Painting Application Specification
   m. SSPC-PA 2 — Measurement of Dry Coating with Magnetic Gauges
   n. SSPC-PA 3 — A Guide for Safety in Paint Application
   o. SSPC-Guide 12 — Guide for Illumination of Industrial Painting Projects

1.03 DEFINITIONS

A. "Paint" as used herein means all coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.04 SUBMITTALS

A. Product Data: for each paint system specified, including block fillers and primers.
   1. Provide the manufacturer's technical information including label analysis and instructions for handling, storage, and application of each material proposed for use.
   2. List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.
   3. Product data sheets shall indicate the mixing and thinning directions, and recommended spray nozzles and pressures.

B. Samples for verification purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Define each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.

C. Provide safety data sheets (SDS).

1.05 QUALITY ASSURANCE

A. Engage an experienced applicator that has experience in industrial or heavy commercial painting system applications and experience in painting wastewater or water treatment plants. The submission of five (5) successful paint projects of similar nature will be required if the Engineer is not familiar with the Subcontractor’s work.

B. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

C. Material Quality: Provide the manufacturer's paint material of the various coatings as specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

D. Compatibility: Materials specified herein are compatible and complete systems. Any incompatible primers or barrier coats shall be removed and re-primed as directed by the Engineer. Notify the Engineer in writing of any anticipated problems using specified coating systems with substrates primed by others.

E. Paint sample areas to establish standards on quality of workmanship as directed by the Engineer and to establish a basis for acceptability of the coating work. Project mock-ups and samples approved by the Engineer shall stay in place the remainder of the project to provide a standard of quality to which production work will be compared.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's lot number.
4. Manufacturer's stock number and date of manufacture.
5. Contents by volume, for pigment and vehicle constituents.
6. Thinning instructions.
7. Application instructions.
8. Color name and number.
9. Expiration date (after which the product should not be used).

B. Containers that have been broken, opened, water marked and contain caked, lumpy or otherwise damaged materials are unacceptable and shall be removed from the work site immediately.

C. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue. The Contractor shall exercise every precaution in the storage of paints, solvents, cleaning fluids, rags and similar materials to eliminate the risk of spontaneous combustion or other hazardous conditions. Portable fire extinguishing equipment shall be provided in a convenient location for emergency access. All painting materials stored on the job site shall be stored in a location consistent to the manufacturer’s storage requirements. The Contractor shall take all safety precautions in accordance with Section 7 of AWWA d-102 and NFPA Bulletin No. 101.

1.07 PROJECT/SITE CONDITIONS

A. Apply paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C). These temperatures need to be maintained throughout the minimum cure time as recommended by the manufacturer.

B. The coatings shall be supplied for normal use without thinning. If it is necessary to thin the coating for proper application in cool weather or obtain better coverage for a protected coating of urethane application, the thinning shall be done in accordance with manufacturer's recommendations.

C. Do not apply paint to wet or damp surfaces, or during snow, rain, fog, or mist. No paint shall be applied when it expected that the relative humidity will exceeds 85 percent or that the air temperature will drop below manufacturer’s requirements within 18 hours after the application of the paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, painting shall be delayed until the Engineer is satisfied that the surface is dry.

D. Air quality permits, requirements, and other construction related permits shall be the responsibility of the Contractor. Copies of the permits shall be attached to the Field Superintendents copy of the specifications and shall be on the job site at all times.

E. Adjacent Work – Protect work of other trades covered in these specifications and in other sections and in other sections against damage by painting and finishing work. Correct any damage by repairing, cleaning, replacing, or repainting any of the damaged areas as acceptable to the Engineer.

F. Provide "Wet Paint" signs as required to protect freshly painted surfaces from the damage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: All materials specified herein shall be base bid as manufactured by the Tnemec Company, Inc., Kansas City, MO. These products are specified to establish standards of quality and are approved for use on this project. The listing or description of these products shall not be construed so as to eliminate from competition other products of equal performance, which are similar in design, function, and performance. The products were selected by application, performance requirements, and ASTM Testing. Proposed alternates shall meet or exceed criteria (application, performance, and ASTM testing) for each product. Materials by other manufacturers shall be approved per Section 01 60 00 – "Materials and Equipment."

2.02 PAINT MATERIALS

A. Material Compatibility: Provide block fillers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

B. Colors: Provide color selections made by the Owner from the manufacturer's full range of standard colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The Contractor shall examine Work-in-Place that work included in this section is dependent. Any defects that may influence the satisfactory performance of any work of this section shall be corrected in accordance with the requirements governed by the section under which the defects are noted. The Contractor shall be solely responsible for assuring that Work-in-Place is acceptable to satisfy the requirements of this section. Commencement of work under this section shall be construed as Work-in-Place being acceptable to the Contractor.

B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total system for various substrates on request. Furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Engineer about anticipated problems using the materials specified over substrates primed by others.

3.02 PREPARATION:

A. General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied

protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions and SSPC for each particular substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove and re-prime. Notify the Engineer in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
2. *Cementitious Materials:* Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, laitance, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
   c. Thin first coat of coal tar to allow penetration into concrete, per manufacturer's recommendations.

3. *Concrete – Below Grade Non-Immersion:* All concrete shall be allowed to cure twenty-eight (28) days before applying any coatings. Prepare referencing SSPC-SP 13 Surface Preparation of Concrete. All surfaces must be clean, dry and free of contaminants.

4. *Concrete – Above Grade Exterior Exposed and Interior Non-immersed*: Allow concrete to cure twenty-eight (28) days before applying any coatings. Prepare referencing SSPC-SP 13 Surface Preparation of Concrete. All surfaces must be clean, dry and free of contaminants.

5. *Concrete Masonry Units*: Allow mortar to cure for twenty-eight (28) days. Level protrusions and mortar splatter. Prepare referencing SSPC-SP 13 Surface Preparation of Concrete. All surfaces shall be clean, free of efflorescence, chalk, dust, grease, oils and dry.

6. *Concrete Floor*: Concrete floors shall be allowed to cure twenty-eight (28) days. Mechanically abrade by means of abrasive shot blast or diamond grinding equipment referencing SSPC-SP 13 Surface Preparation of Concrete to uniformly produce the required surface ICRI CSP surface profile. Acceptable equipment to produce the required surface profile shall be as prescribed per ICRI Technical Guideline No. 310.2R, Table 7.2, with the noted exception that acid etching and surface retarders shall not be permitted. Floors shall be free of laitance, clean and dry before applying coatings.

7. *Previously Coated Concrete – Exterior:* Power washing at 2500 psi with detergent or brush off blast referencing SSPC-SP 13 Surface Preparation of Concrete required. Concrete shall be clean and dry before applying coatings.

8. *Previously Coated Concrete & Concrete Masonry – Interior:* Power washing at 2500 psi with detergent required except where electrical components could be damaged. Hand

tools shall be used around electrical panels and equipment. Protect all panels and equipment. Concrete shall be clean and dry before applying coatings.

9. *Ferrous Metals:* Clean non-galvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances.

    a. All the surfaces to be coated shall be blast cleaned in accordance with the surface preparation standard listed in the schedule.
    b. The abrasive used for blast cleaning shall be an approved low dusting abrasive and shall have a gradation such that the abrasive will produce a uniform profile of 1 to 2.5 mils, as measured with extra coarse Testex Replica Tape.
    c. All abrasive and coating residue shall be removed from steel surfaces with a commercial grade vacuum cleaner equipped with a brush-type cleaning tool, or by double blowing. If the double blowing method is used, the exposed top surfaces of all structural steel, including flanges, longitudinal stiffeners splice plates, hangers, etc., shall be vacuumed after the double blowing operations are completed. The airline used for blowing the steel clean shall have an in-line water trap and the air shall be free of oil and water as it leaves the air line. The steel shall then be kept dust free and primed within eight (8) hours after blast cleaning.
    d. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.

10. *Non-Ferrous*: Clean non-ferrous surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants as defined in SSPC-SP1, followed by abrasive blasting referencing SSPC-SP 16
11. *Ductile Iron*: NAFP 500-03-04 Abrasive Blast Cleaning of Ductile Iron Pipe
12. *PVC Pipe:* Sand using 36 grit paper all PVC piping that is to receive coatings to roughen up the surface and create a profile. All sanded surfaces shall be clean and dry before applying coatings.
13. *Copper Pipe:* Abrade surface to generate a profile for mechanical adhesion.

C. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.
    1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
    2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
    3. Use only thinners approved by the paint manufacturer, and only within recommended limits.
    4. Epoxy, Coal Tar Epoxy and Urethane Coatings:
        a. The coating shall be mixed with a high shear mixer (such as Jiffy Mixer) in accordance with the manufacturer's directions, to a smooth, lump-free consistency. Paddle mixers or paint shakers are not permitted. Mixing shall be done, as far as possible, in the original containers and shall be continued until all of the metallic powder or pigment is in suspension. Care shall be taken to ensure that all of the coating solids that may have settled to the bottom of the container are thoroughly dispersed. The coating shall then be strained through a screen having openings no larger than those specified for a No. 50 sieve in ASTM E11. After straining, the mixed primer shall be kept under continuous agitation up to and during the time of application.

3.03 APPLICATION

A. Apply paint in accordance with manufacturer's directions and good painting practices under SSPC. Use applicators and techniques best suited for substrate and type of material being applied.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, fraying surfaces or conditions detrimental to formation of a durable paint film.
1. Paint colors, surface treatments, and finishes are indicated in "schedules."
2. Provide finish coats that are compatible with primers used.
3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
6. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
8. Paint back-sides of access panels and removable or hinged covers to match exposed surfaces.
9. Finish doors on tops, bottoms, and side edges same as exterior faces.
10. Sand lightly between each succeeding enamel or varnish coat.
11. Omit primer on metal surfaces that have been shop-primed and touch up painted.

C. Proper curing conditions for ferrous metals will be required between the applications of all coats. The minimum curing time between coats and the maximum time between coats shall be in accordance with the manufacturer's recommendation except that no more than sixty, (60), calendar days will be permitted between coats. If the maximum time between coats is exceeded, all newly coated surfaces shall be completely blast cleaned again to a near-white finish (SSPC-SP10) and recoated and shall be at the Contractor's expense. Whatever metal is cleaned during a working day shall be coated with the prime coat the same day. After the steel is primed, it shall be vacuumed again before subsequent coating. If for any reason this vacuuming does not remove all the accumulated dust and/or dirt, or if more than three (3) weeks has elapsed since the steel was primed, or if in the opinion of the Engineer the surface is unfit for top-coating, the surface shall be scrubbed with a mild detergent solution (any commercial laundry detergent) and thoroughly rinsed with water and allowed to dry for twenty-four (24) hours before the surface is coated.

D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer and as stated in paint schedules. If the application of coating at the required thickness in one (1) pass produces runs, bubbles, or sags, the coating shall be applied in multiple passes, the passes separated by several minutes. Where excessive coating thickness produces “mud-cracking”, such coating shall be scraped back to soundly bonded coating and the area recoated to the required thickness. All dry spray shall be removed, by sanding if necessary. In areas of deficient primer thickness, the areas shall be thoroughly cleaned with power washing equipment, as necessary to remove all dirt; the areas shall then be wire brushed, vacuumed, and recoated. Each undercoat shall be tinted a lighter shade to facilitate identification of each coat where multiple coats are applied. The Engineer will require certification from the approved

coating manufacturer that sufficient materials of each coating specified were purchased to complete the scope of work indicated in these specifications and on the drawings.

E. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.

F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

G. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.

H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

I. Transparent (Clear-White) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.

J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

K. All metal coated with impure unsatisfactory or unauthorized coating material or coated in an unworkmanlike or objectionable manner shall be thoroughly cleaned and recoated or otherwise corrected as directed by the Engineer.

3.04 FIELD QUALITY AND CONTROL

A. The Contractor shall provide access to the job site and areas of work at all times during normal working hours for the Owner. This requirement includes both shop and work in the field.

B. The Engineer or an outside inspection service representing the Owner may make inspections of the work in progress and completed work. Contractor shall coordinate with Engineer or outside inspection agency to allow for inspections after surface preparation and after each coating is applied.

Should the Engineer be summoned to inspect a completed phase of the work and find the work incomplete and therefore, not ready for inspection, the Contractor shall bear the cost of the inspection. It is not the intent to charge the Contractor for an inspection if discrepancies are found in the completed phase of the construction as long as the discrepancies do not necessitate additional inspection trips. Field inspections may be performed by the Engineer according to the following outline:

1. Surface Preparation:
   a. Surface appearance per SSPC checked with visual standards.
   b. Anchor profile checked with replica tape.
2. Coating Conditions:
   a. Temperature of steel using a surface thermometer.
   b. Determination of relative humidity and dew point and air temperature using a sling psychrometer.
3. Verification of Coating Thickness:
   a. Dry film thickness will be determined by use of a magnetic film thickness gauge.
   b. Pin holes will be checked using a holiday detector.

4. The Contractor shall supply the following test equipment and standards. This equipment shall be on the job site and available to the on-site inspector at all times:
   a. Wet Film Thickness Gauges
   b. SSPC Vis-1 pictorial standards
   c. Magnetic Dry Film Thickness Gauge 0 to 45 mils
   d. Dry Film Thickness Calibration Standards
   e. Tooke Gauge
   f. Holiday detection device
   g. Surface Temperature Gauges
   h. Sling Psychrometer or equal

C. Failure to comply with these specifications in any manner shall be sufficient cause for rejection of work.

3.05 CLEAN-UP AND PROTECTION

A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

C. Protect work of other trades, whether to be painted or not, against damage by painting. Correct the damage by cleaning, repairing or replacing, and repainting, as acceptable to the Engineer.

D. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
   1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 PAINT WASTE

A. See Section 02 41 00 – “Demolition” and Appendix B. The Contractor shall be responsible for any paint waste generated during work in the existing buildings.

B. The Contractor shall be responsible for correctly disposing of all material generated by his performance of the work.

C. Documentation shall be provided to the Engineer/Owner regarding proper testing and disposal of paint waste. All testing and disposal procedures shall meet or exceed those required by the State of Michigan Department of Environment, Great Lakes, and Energy and/or any other governmental bodies that have jurisdiction over waste in the State of Michigan.

D. If paint waste is generated, as a minimum, three samples shall be taken and analyzed for lead content and any other hazardous material as required by local, State and federal governing bodies before a dumpster containing paint waste may be removed from the job site. These samples shall be taken and tested by an independent laboratory and paid for by the Contractor as a part of this contract. The results of these tests must be submitted to the Engineer/Owner and the Contractor shall receive written approval for the removal of any dumpster.

E. The cost of disposing of any waste shall be part of the Contractor’s original proposal and will not be considered as an extra to the Contract.

F. Dust and blast products shall be completely removed prior to recoating by high pressure air or vacuum cleaning.

3.07 PAINT SCHEDULE

A. General: Paint all surfaces as noted in this Paint Schedule and the Finish Schedules included in the Drawings. Also paint items and surfaces where noted on the Drawings and in the Sections of the Specifications. NOTIFY ENGINEER when ready to select colors and, again, when ready to commence the work, and prior to applying the final coat. Where only two coats are noted, the result must give total coverage or an added coat shall be applied.

1. All non-wearing surfaces, supports, frames, etc., except galvanized parts, shall be painted in accord with the painting schedule.
2. Paint hollow metal doors and frames and overhead doors.
3. Paint the following items if exposed to view and not factory finished:
   a. Masonry walls.
   b. Metal, except stainless steel, copper, brass, and aluminum unless noted.
   c. Mechanical ductwork, piping (including copper and brass), and associated supports, cabinets, covers, grilles, register, diffusers and appurtenances.
   d. Electrical conduit, boxes, panels, and appurtenances.
4. When exposed to the exterior elements and not factory finished, paint the following items:
   a. Metal, except stainless steel, copper, brass or aluminum unless noted.
   b. Concrete
   c. Block masonry
   d. Mechanical stacks, vents, pipes, drain cocks, equipment and appurtenances.
   e. Electrical panels, equipment and appurtenances.
5. Factory finishes shall be touched up with a matching material if scratched, stained or otherwise damaged. When noted, factory finished items shall be field painted. Prime coat, galvanizing or similar treatment do not constitute a factory finish exempted from field painting. The overhead door shall be painted at the job site.
6. Do not paint over code required labels such as UL or FM, or any equipment identification, performance rating, name or nomenclature plates.
7. Do not paint moving parts of operating mechanical and electrical equipment such as valve and damper operators, linkages, sensing devices, or motor and fan shafts.
8. The following painting schedule is based on the products of the Tnemec Company, Inc. Schedule contains minimum number of coats required to achieve specified dry film thickness.
9. See Section 40 05 13 – "Process Piping" for coating of inside of pipes. Interior and exterior noted in schedule below refers to building environment.

B. CONCRETE FLOORS, PADS & WALLS

Concrete Floors & Equipment Pads: (New and Existing Construction, "Painted Floors" in Room Finish Schedules included in the Drawings)

Surface Prep:	SSPC-SP-13	
Prime:	Tnemec Series 201	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 280	6.0 to 12.0 mils DFT

Interior Concrete Walls & Ceilings: (New Construction and south face of existing south wall in the existing clarifier room)

Surface Prep:	3.02.B.4	
Prime:	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 113	4.0 to 6.0 mils DFT

Interior Concrete Walls & Ceilings: (Existing Painted Construction where disturbed by construction)

Surface Prep:	3.02.B.8	
Prime:	Tnemec Series 151	180 to 400 sq. ft./gal
Finish:	Tnemec Series 113	4.0 to 6.0 mils DFT

C. CONCRETE MASONRY UNITS

Interior CMU Walls: (Existing Painted Construction where disturbed by construction)

Surface Prep:	3.02.B.8	
Prime:	Tnemec Series 151	180 to 400 sq.ft./gallon
Finish:	Tnemec Series 113	4.0 to 6.0 mils DFT

Interior CMU Walls: (New Construction, and former exterior wall of Ex. Clarifier Building)

Surface Prep:	3.02.B.5	
Filler:	Tnemec Series 130-6602	85 to 100 sq.ft./gallon
Intermediate:	Tnemec Series 113	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 113	4.0 to 6.0 mils DFT

F. DUCTILE IRON PIPE

Exterior Ductile Iron Pipe and Fittings (New Construction)

Surface Prep:	NAPF 500-03-04/NAPF 500-03-05	
Shop Prime:	Tnemec Series 37H, N69, or V69	2.0 to 3.5 mils DFT
or Field Prime:	Tnemec Series V69	2.0 to 3.5 mils DFT
Intermediate:	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 1094	2.0 to 3.0 mils DFT

Interior Ductile Iron Pipe and Fittings (Existing Construction within one pipe segment of all connections of proposed piping to existing piping)

Spot Surface Prep:	NAPF 500-03-04/NAPF 500-03-05	
Spot Prime:	Tnemec Series V69	2.0 to 3.0 mils DFT
Intermediate:	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series V69	4.0 to 6.0 mils DFT

Interior Ductile Iron Pipe and Fittings (New Construction including interior of buildings and interior of below-grade chambers)

Surface Prep:	NAPF 500-03-04/NAPF 500-03-05	
Shop Prime:	Tnemec Series 37H, N69, or V69	2.0 to 3.0 mils DFT
or Field Prime:	Tnemec Series V69	2.0 to 3.0 mils DFT
Intermediate:	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series V69	4.0 to 6.0 mils DFT

G. STEEL PIPE

Exterior Steel Pipe (New Construction)

Surface Prep: SSPC-SP-6	
Shop Prime: Tnemec Series 66	4.0 to 6.0 mils DFT
or Field Prime: Tnemec Series 94-H2O	2.5 to 3.5 mils DFT
Intermediate: Tnemec Series V69	4.0 to 6.0 mils DFT
Finish: Tnemec Series 1094	2.0 to 3.0 mils DFT

Interior Steel Pipe (Existing Construction where damaged by construction activities)

Spot Surface Prep: SSPC-SP-11	
Spot Prime: Tnemec Series 1	2.5 to 3.5 mils DFT
Finish: Tnemec Series V69	4.0 to 6.0 mils DFT

Interior Steel Pipe (New Construction, Blower Piping Only)

Surface Prep: Shop prime of pipe exterior coating shall be completed by others prior to arrival at site in accordance with Section 40 05 13 – "Process Piping."

Field Touch-up: Tnemec Series V69, as required	
Intermediate: Tnemec Series V69	4.0 to 6.0 mils DFT
Finish: Tnemec Series V69	4.0 to 6.0 mils DFT

J. NON-FERROUS PIPE

Interior Insulated Pipe

Surface Prep:	Surface shall be dry and clean	
Prime:	Tnemec Series 1026 Enduratone	2.0 to 3.0 mils DFT
Finish:	Tnemec Series 1026 Enduratone	2.0 to 3.0 mils DFT

Exterior Insulated Pipe

Surface Prep:	Surface shall be dry and clean	
Prime:	Tnemec Series 1026 Enduratone	2.0 to 3.0 mils DFT
Finish:	Tnemec Series 1026 Enduratone	2.0 to 3.0 mils DFT

Interior Copper Pipe

Surface Prep:	3.02.B.13	
Prime:	Tnemec Series V69	3.0 to 4.0 Mils DFT
Finish:	Tnemec Series V69	3.0 to 4.0 Mils DFT

K. EQUIPMENT

Interior Factory Primed Equipment and Motors – RAS Pumps, Grit Pump (New Construction)

Shop Prime:	Tnemec Series 37H, N69, or V69	2.0 to 3.0 mils DFT
Surface Prep:	Surface shall be dry and clean	
Prime:	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series V69	4.0 to 6.0 mils DFT

Exterior Factory Primed Equipment and Motors – Clarifier Motors and Reducers (New Constuction)

Shop Prime:	Tnemec Series 37H, N69, or V69	2.0 to 3.0 mils DFT
Surface Prep:	Surface shall be dry and clean	
Prime:	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 1094	2.0 to 3.0 mils DFT

Steel Hydropneumatic Tank
Shop Prime: See Section 43 21 13.10

Prime:	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series V69	4.0 to 6.0 mils DFT

L. STRUCTURAL STEEL & MISCELLANEOUS METALS

Interior Structural Steel

Surface Prep:	SSPC-SP2	
Prime:	Tnemec Series 133	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 138	4.0 to 6.0 mils DFT

Exterior Structural Steel – Including exterior pipe supports

Surface Prep:	SSPC-SP2	
Prime:	Tnemec Series 132	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 1094	2.0 to 3.0 mils DFT

Steel Plates & Shapes (Pipe Supports, Hangers, Etc.)

Surface Prep:	SSPC-SP6	
Prime:	Tnemec Series 94-H2O	2.5 to 3.5 mils DFT
Intermediate:	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 1094	2.0 to 3.0 mils DFT

Steel Primary and Final Clarifier Internals: Immersion Service
Surface Prep: Per Sections 46 43 23.10 and 46 43 23.20
Shop Prime: Per Sections 46 43 23.10 and 46 43 23.20

Intermediate:	Tnemec Series 21	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 21	4.0 to 6.0 mils DFT

Steel Primary and Final Clarifier Internals: Non-Immersion Service
Surface Prep: Per Sections 46 43 23.10 and 46 43 23.20
Shop Prime: Per Sections 46 43 23.10 and 46 43 23.20

Field Prime:	Tnemec Series V69	4.0 to 6.0 mils DFT
Intermediate:	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 1094	2.0 to 3.0 mils DFT

Hollow Metal Doors and Frames (New Construction)
Surface Prep: SSPC-SP6

Shop Prime:	Per door/frame manufacturer	
Intermediate:	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 1094	2.0 to 3.0 mils DFT

Steel Handrail (New Construction)_

Surface Prep:	SSPC-SP6	
Shop Prime:	Tnemec Series 94-H2O	2.5 to 3.5 mils DFT
Field Touchup	Tnemec Series V69	4.0 to 6.0 mils DFT
Finish:	Tnemec Series 1094	2.0 to 3.0 mils DFT

M. INTERIOR METAL DOOR FRAMES

Surface prep:	Clean and Dry	
Prime:	Spot Touch Primer	
First Coat:	Tnemec Series 113 HB Tneme-tufcoat	4.0-6.0 mils DFT
Second Coat:	Tnemec Series 113 HB Tneme-tufcoat	4.0-6.0 mils DFT

3.08 WASTEWATER TREATMENT FINISH COLOR SCHEME

A. Color Selection: Paint colors will be selected by Engineer. Before painting the Contractor shall submit Paint Specifications and color chips for review by Engineer.
   1. Furnish colors exactly matching the selected colors.
   2. Obtain approval from Engineer of proposed color matches.
   3. Paint wood, metal, and mechanical and electrical appurtenances the same color as adjacent building surface unless noted.
   4. Refer to architectural drawings for special painting considerations for accent color walls.
   5. The "Ten State Standards" recommended piping color scheme shall be utilized for piping and is as follows:

a)	Compressed Air	Dark Green
b)	Sludge	Brown
c)	Grit	Olive Green
d)	Wastewater	Gray
e)	Non-potable Water	Blue with Black Bands
f)	Natural Gas	Dark Red with Black Bands
g)	Plumbing Drains and Vents	Black
h)	Electrical Conduit	Match surrounding structure

   6. Verify pipe color scheme with Engineer prior to application to confirm whether a different shade from the above listed piping color scheme is required.
   7. Flexible electrical conduit shall remain unpainted.

3.09 LABELS

A. Piping shall be identified by labels and flow arrows every ten feet with at least two labels in each room.

B. The contents and direction of flow shall be stenciled on the piping with paint in a contrasting color. Coordinate label text with Owner and Engineer.

C. Minimum text size for 16" and larger pipe shall be 4".

D. Minimum text size for pipe smaller than 16" shall be 2".

E. Labels for PVC and copper pipe shall not be painted, see Section 40 05 13 – "Process Piping."

F. Pipe contents and flow direction labels shall NOT be included in the allowance for signage.

3.10 SURFACE PREPARATION - SSPC DESCRIPTIONS

A. Reference is made to Steel Structures Painting Council (SSPC) surface preparation specifications for recommended surface cleaning.

SSPC-SP-1 Solvent Cleaning:
Removal of oil, grease, dirt, soil, salts and contaminants by cleaning with solvent, vapor, alkaline emulsion or steam.

SSPC-SP-2 Hand Tool Cleaning:
Removal of loose rust, loose mill scale and loose paint to degree specified, by hand chipping, scraping, sanding and wire brushing.

SSPC-SP-3 Power Tool Cleaning:

Removal of loose rust, loose mill scale and loose paint to degree specified, by power tool chipping, de-scaling, sanding, wire brushing and grinding.

SSPC-SP-5 White Metal Blast Cleaning:
Removal of all visible rust, mill scale and foreign matter by blast cleaning with wheel or nozzle (dry or wet) using sand, grit or shot. (This procedure is for work in a corrosive atmosphere where the high cost of cleaning is warranted).

SSPC-SP-6 Commercial Blast Cleaning:
Blast cleaning until at least two-thirds of the surface area is free of all visible residues. Discoloration caused by certain stains shall be limited to no more than thirty three percent (33%) of each square inch of surface area.

SSPC-SP-7 Brush-Off Blast Cleaning:
Blast cleaning of all except tightly adhering residues of mill scale, rust and coatings, exposing numerous evenly distributed flecks of underlying metal.

SSPC-SP-8 Pickling:
Complete removal of rust and mill scale by acid pickling, duplex pickling or electrolytic pickling.

SSPC-SP-10 Near-White Metal Blast Cleaning:
The removal of all rust, oil, grease, dirt, dust, mill scale, oxides, corrosion products and other foreign matter by compressed air nozzle blasting. Discoloration caused by certain stains shall be limited to no more than five percent (5%) of each square inch of surface area. (For high humidity, chemical atmosphere, marine or other corrosive environments).

SSPC-SP-11 Power Tool Cleaning to Bare Metal:
The removal of all visible oil, grease, dirt, dust, mill scale, rust, paint oxide, corrosion products, and other foreign matter by the use of surface cleaning power tools.

SSPC-SP-13 Surface Preparation of Concrete:
The use of mechanical, chemical, or thermal methods to remove all protrusions, defects, damaged or unsound concrete, contamination, form release agents, efflorescence, curing compounds, and existing coatings determined to be incompatible with the coating to be applied.

B. Mill scale, rust and paint are considered tightly adherent if they cannot be removed by lifting with a dull putty knife.

3.11 SURFACE PREPARATION - NAPF DESCRIPTIONS

A. Reference is made to National Association of Pipe Fitters (NAPF) surface preparation specifications for recommended surface cleaning of ductile iron pipe and fittings.

NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe:
Removal of all visible dirt, dust, loose annealing oxide, loose rust, loose mold coating and other foreign matter. All oils, small deposits of asphalt paint and grease shall have been removed prior to blasting by solvent cleaning per NAPF 500-03-01. After the entire surface to be coated is struck by the blast media, tightly adherent annealing oxide, mold coating and rust staining may remain on the surface provided they cannot be removed by lifting with a dull putty knife. No asphaltic coating shall be allowed to remain.

NAPF 500-03-05 Abrasive Blast Cleaning for Ductile Iron Fittings:

Removal of all visible dirt, dust, loose annealing oxide, loose rust, loose mold coating and other foreign matter. All oils, small deposits of asphalt paint and grease shall have been removed prior to blasting by solvent cleaning per NAPF 500-03-01. After the entire surface to be coated is struck by the blast media, tightly adherent annealing oxide, mold coating and rust staining may remain on the surface provided they cannot be removed by lifting with a dull putty knife. For fittings previously coated with asphaltic paint, no staining may remain on the surface after abrasive blast cleaning.

END OF SECTION

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SECTION 09 96 56
EPOXY COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes surface preparation, painting, and finishing of all exposed concrete surfaces in the entire inlet/splitter box area, the headworks building channels, and the new clarifier inlet box.

1.02 QUALIFICATIONS

A. The coating Applicator shall have a minimum of five (5) years' experience in the application of epoxy coatings and at least five projects of similar size, scope and difficulty.

1.03 SUBMITTALS

A. Provide a minimum of five references of similar size and scope for Contractor actually involved in application of coating system. References shall include the name of project, the type of structure coated, date of work, name and telephone number of Owner's contact.

B. Submit written verification from the coating manufacture documenting authorization for applicator to install coating system.

C. Provide manufactures' written instructions for applying and repairing the specified coating system in the manner specified herein, including material handling, mixing ratios, mixing procedures, proper application temperature and environmental controls during application.

D. Provide material safety data sheets.

E. Test Reports

Performance Testing

Submit certified test reports, to the Engineer, from an approved independent third party laboratory that the specified coating material was manufactured and tested in accordance with the ASTM standards specified herein, and are of the same formulation as tested and specified. All tests shall be completed at the specified final coating thickness.

ASTM D790	Flexural Strength
ASTM D790	Flexural Modulus
ASTM D638	Tensile Strength
ASTM D638	Ultimate Elongation
ASTM D2240	Shore Hardness
ASTM D1653	Water Vapor Transmission, Method B, condition C
ASTM D1653	Water Vapor Permeance, Method B, condition C

Chemical Testing

Submit to the Engineer from an approved independent third party laboratory, Gel Permeation Chromatography and Fourier Transform Infrared Spectroscopy results for each component of the specified coating system, in its cured and uncured state.

1.04 WARRANTY

A. Applicator shall warrant all work against defects in materials and workmanship for a period of five (5) years from the date of final acceptance of the project. A one-time inspection shall be completed by the applicator, one year from the date of project acceptance. The applicator shall, upon written notice, repair defects in materials or workmanship which may develop during said five year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Base bid epoxy coating shall be AQUATAPOXY A-6 manufactured by Raven Lining Systems, Warren Environmental's S-301 system, or Engineer Approved Equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Coatings shall be applied to all interior surfaces of the structures noted in 1.01A, protruding pipes, and inverts to provide a 100 percent physically bonded monolithic pinhole free coating that meets the requirements specified herein. The cured surface shall be smooth, continuous, no runs or sags and with proper sealing connections to all unsurfaced areas. Contractor shall prevent coating material from entering sewer pipe, accumulating within the flow channel, or covering equipment.

B. All material shall be new and be delivered to the project site in un-opened containers that plainly show, at the time of use, the designated name, date of manufacture, and name of manufacture, batch or lot number. Resins shall be stored in a suitable protected area that is heated or cooled as required to maintain temperatures within the range recommended by the resin manufacture.

C. No coating shall be immersed without proper curing specified by the manufacturer.

D. **No lining application shall be permitted when above grade atmosphere temperatures fall below 60 deg F.** Temperature of the surface to be coated shall be between 55 deg F and 90 deg F during application of the coating. Prior to and during application, care shall be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Portable heaters shall not be used at any time during the coating process.

3.02 SURFACE PREPARATION

A. Applicator shall inspect all surfaces specified to receive a protective coating prior to surface preparation. Applicator shall notify Engineer of any noticeable disparity in the surfaces, which may interfere with the proper preparation of the protective coating.

B. Any existing conditions/products that may be incompatible with the specified coating or the compressive or tensile strength of the product is in question, the bond strength of the coating shall be tested via a test patch and elcometer test prior to coating and evaluated by the Engineer.

C. Metal Surfaces

All workmanship for metal surface preparation shall be in strict conformance with the current Steel Structures Painting Council (SSPC) specifications for SP 5, White Metal Blast Cleaning for severe-duty immersion service of the coated areas. Anchor profile shall be 3.0-5.0 mil.

All metal surfaces to be coated shall be dry abrasive blast cleaned only. All loose scale, large deposits, oil, grease, cutting oils, direct and other contaminants shall be removed prior to abrasive blasting.

Compressed air used for abrasive blasting should be free of oil and water. Filter separators which remove both contaminants must be inserted in the compressed air lines as close as possible to the blasting equipment.

The abrasive blast material shall be a crushed slag material to produce a surface profile that meets the criteria above. The abrasive shall not be reused. All blast media and other debris shall be contained within the structure and removed on a daily bases by dry extraction methods and disposed of by the applicator, in a approved landfill.

Abrasive blasting shall not be performed when; the air or metal surface temperature is below 40 deg F, when the relative humidity exceeds 80%, or when the metal surface temperature is less than 5 deg F warmer than the dew point.

Surfaces shall be coated the same day they are abrasive blasted. Surfaces that show signs of flash rust, before they are coated, shall be re-blasted.

D. Concrete Surfaces

All concrete surfaces to be coated shall be prepared as specified herein to ensure adequate profile and porosity in order to provide a strong bond between the concrete and the coating.

All concrete that is not sound or has been damaged by corrosion shall be removed to a sound concrete surface. The remaining surface shall be inspected by the Engineer prior to coating.

Standard Portland Cement or new concrete shall be properly cured for a minimum of 28 days prior to application of the protective coating. Quick setting high strength cement, if used, shall be approved by the coating manufacturer for coating.

All concrete surfaces to be coated shall be dry abrasive blast cleaned. Compressed air used for abrasive blasting should be free of oil and water. Filter separators which remove both contaminants must be inserted in the compressed air lines as close as possible to the blasting equipment. The abrasive blast material shall be a crushed slag material to produce a surface profile that provides a clean open and exposed aggregate surface. The abrasive shall not be reused. All blast media and other debris shall be contained within the structure and removed on a daily bases by dry extraction methods and disposed of by the applicator, in an approved landfill. Upon completion of the dry abrasive blast the surface to be coated shall be inspected by the applicator to insure the desired profile has been attained.

All contaminants including, but not limited to; oils, grease, dirt, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed by a environmentally safe degreaser, detergent, or other suitable cleaning methods.

The surface shall be water blasted to remove any tightly adhered grease or other contaminants by using a mild solution of trisodium phosphate and water mixed in accordance with manufacturer

instructions. Under no circumstances shall the surface being water blasted receive less than 2000 psi.

Following removal of all contaminants, the surface shall be acid etched with a 10%-20% muriatic acid solution to clean and open the pores of the substrate. The surface shall then be water blasted again.

Active water infiltration shall be stopped by the applicator using a cementitious water plug or hydroactive grout, which is compatible with the specified repair mortar and is suitable for topcoating with the specified coatings.

The prepared concrete surface shall have a pH between 6.0 and 8.0, adjust pH in accordance with manufacturers recommendations. Test results shall be taken prior to the coating application and retained for review by the Engineer.

Prior to application of the coating the concrete surface shall be sprayed with a chlorine bleach solution sufficient to kill any living microorganisms on the concrete.

3.03 APPLICATION

A. Application procedures shall conform to the recommendations of the coating manufacturer, including material handling, mixing ratio, mixing, proper coating application temperatures, environmental controls during application, and safety.

B. During application coatings shall be protected against exposure to direct sunlight or other intense heat source.

C. The coating shall be applied to all surfaces in a manner that will produce a smooth continuous even film of uniform thickness. The total coating thickness shall be not less than 120 mils. Each coat shall be sprayed only via a pleural component pumping system approved by the manufacture for the application of specified coating. The color shall be blue.

D. Only airless spray application equipment shall be used to apply the specified coating.

E. Following the application and curing of the intermediate coats the entire structures surface shall be inspected for any surface defect, pinholes, bugholes, or honeycomb in excess of 1/16 of an inch shall be repaired, prior to the application of the final coat according to the manufactures recommended practices and Engineer approval.

F. If necessary, the application of additional coats of the coating should occur as soon as the prior or basecoat becomes tack free, but no more than 24 hours after the prior coat has been applied. Should 24 hours pass prior to recoating, the coating Contractor shall pressure wash the surface to be coated with a minimum of 2,000 psi prior to additional lining application.

3.04 COATING REPAIR PROCEDURE

A. Coating repair procedure shall be submitted to the Engineer for approval.

3.05 PIPE/STRUCTURE INTERFACE

A. All pipe and structure interfaces shall be built up and hand troweled to a smooth uniform transition from pipe to structure interface with the specified material or Engineer approved equal. The connection shall provide a smooth continuous bond to all pipes and structure interface.

3.06 INSPECTION AND TESTING

A. All testing shall be performed by the Applicator in the presence of the Owner or Engineer.

B. Verification of coating thickness shall be accomplished by standard wet gauge testing as the coating is applied. The final coating dry film thickness shall be verified by the applicator at a minimum of twenty random locations by an ultrasonic detector (PosiTector 100-C1 or equivalent).

C. Following the necessary curing of the lining material the entire structure surface shall be inspected and spark tested. The spark tester shall be set at a minimum of 200 volts per 1 mil of dry film thickness or maximum of 12,000 volts.

D. The adhesion of the coating shall be tested as follows:

- Twelve (12) destructive pull tests within inlet/splitter box (8 pull tests on structure walls, 4 tests on structure floors)

- Twelve (12) destructive pull tests within the headworks channels (8 pull tests on channel walls, 4 tests on structure floors).

- Four (4) destructive pull tests within the new clarifier inlet box (2 pull tests on structure walls, 2 tests on structure floors).

The tests shall be performed on the wall of the structure following ASTM -D4541, no test shall be less than 400 psi. The sample removed shall be retained and examined to determine proper coating bond. Test shall commence no earlier than 72 hours after application of the final coat or per manufacture recommendation. Test areas shall be repaired per Coating Repair procedures stated above. Any areas detected to have inadequate bond strength shall be evaluated by the Engineer. Additional bond tests may be performed at the Coating Contractors expense to determine the extent of potentially deficient bonded areas.

3.07 SAMPLING & LABORATORY TESTING

A. During the project random samples of the coating material will be taken and may be sent to an independent third-party laboratory where the samples of the material will be tested in its cured and uncured state for conformance to the Performance test results submitted by the Coating Contractor. Also during coating, cured and uncured samples of the specified coating may have Gel Permeation Chromatography and Fourier Transform Infrared Spectroscopy test completed; results will be compared to the test submitted by the Coating Contractor to ensure the coating material and mixing meet the intent of the specifications.

B. Retainage samples of all components of the coating material shall be provided from every lot or batch of material used in the project. Samples will be taken from the recirculation line or return line from the pumping system

C. Random plate samples, supplied by the Coating Contractor, will be cast in a manner in which the coating will be applied and approved by the Engineer. The plate sample will be cast with the coating material pumped through the static mixer attached to the pumping system.

D. If it is determined the samples tested do not meet the Performance or Chemical submittals provided by the Coating Contractor, additional testing will be done at the Coating Contractors expense. If it is determined that two (2) samples from the same batch do not match the submittals the structures coated with that batch or lot number will be rejected and no payment will be made.

END OF SECTION

SPECIALTIES

DIVISION 10

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SECTION 10 14 00
SIGNS AND IDENTIFICATION DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:
1. The work under this section includes, but is not necessarily limited to, the furnishing and installation of door or wall mounted informational signage and identification labels and devices.
2. The work shall include signage requested by the Owner:

1.02 SUBMITTAL

A. Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.

B. Submit samples and proposed wording for all signs prior to ordering signs and identifying devices.

1.03 PRODUCT HANDLING

A. During handling, installation and subsequent construction activity, protect identifying devices from damage and protect the work of all other trades. In the event of damage to identifying devices or other installed work, make repairs or replacements as necessary at no additional cost to the Owner.

1.04 ALLOWANCE

A. Provide in the base bid an allowance of $2,500.00 for signs and identifying devices, including installation. Submit an itemized cost breakdown to the Engineer for approval for any item to be charged to this allowance. Contract amount shall be adjusted to reflect actual cost. See Section 01 21 00 – “Allowances” for further information.

PART 2 - PRODUCTS

2.01 SAFETY AND HAZARDOUS CHEMICAL SIGNS

A. Safety signs shall meet all applicable OSHA requirements as to size, colors, wording, and design.

B. All signs shall be approximately 10" x 14" in size. Signs shall be fiberglass (Direct Safety Company, or equal), or other weatherproof material suitable for exterior mounting.

C. Location and wording shall be as directed by the Engineer.

D. Where possible, mount signs flush on walls or doors.

2.02 OTHER SIGNS

A. Other signs as identified in the project completion safety audit will include but not be limited to: confined spaces, no smoking areas, areas requiring hearing protection, and alarm light notices.

B. Material, size, location and wording shall be as directed by the Engineer.

C. Where possible, mount signs flush on walls or doors.

END OF SECTION

SECTION 10 44 16
FIRE EXTINGUISHERS, CABINETS & ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The following:
1. Fire extinguishers.
2. Mounting brackets.

1.02 REFERENCES

A. Portable fire extinguishers shall comply with applicable U.L. Standards and shall be labeled by U.L.

B. National Fire Codes, NFPA 10.

1.03 SUBMITTALS

A. Submit under provision of SECTION 01 33 00 – "Submittals."

B. Submit copies of manufacturer's technical product data and installation instructions for required portable fire extinguishers required.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain fire extinguishers and cabinets from one source from a single manufacturer.

B. UL-Listed Products: Fire extinguishers UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher.

C. FM-Listed Products: Fire extinguishers approved by Factory Mutual Research Corporation for type, rating, and classification of extinguisher and carry appropriate FM marking.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements of this section, provide products of one of the following:

1. J.L. Industries.
2. Larsen's Manufacturing Co.
3. Walter Kidde, Division of Kidde, Inc.

2.02 FIRE EXTINGUISHERS

A. J.L. Industries Model: Cosmic 5E.

B. Larsen's Manufacturing Co. Model: MP5.

C. Walter Kidde, Division of Kidde, Inc. Model: Tri-Class ABC Dry Chemical 2A:40BC.

2.03 MOUNTING BRACKETS

A. Provide manufacturer's standard bracket(s) designed to prevent accidental dislodgment of fire extinguisher(s), of proper size for type and capacity of fire extinguisher(s) indicated, in manufacturer's standard finish.

B. Provide brackets for those extinguishers not located in cabinets.

2.04 SIGNAGE

A. Mounting Bracket(s): Provide identification signage at all locations

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install items included in this Section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

1. Where exact location of surface-mounted bracket-mounted fire extinguishers is not indicated, locate as directed by ENGINEER.

B. Fill and service fire extinguishers for one (1) year after substantial completion of project. Comply with requirements of governing authorities and manufacturer's requirements.

END OF SECTION

DIVISIONS 22 & 23
MECHANICAL SPECIFICATIONS
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SECTION 22 05 00
PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.01 PLUMBING WORK SCOPE SUMMARY

A. General:
1. "Provide" means furnish and install.
2. Although the drawings attempt to depict piping and equipment as installed, actual conditions and locations of existing may differ from that which is shown. Field verify actual conditions prior to bid.
3. Submit equipment and product submittals to Engineer for approval prior to construction.

1.02 WORK SCOPE SUMMARY

A. Headworks Building
1. Plumbing:
a. Provide “Effluent Water” water lines where shown in Headworks Building.
b. Supply water to the grit removal system etc as shown.
c. Provide a sanitary drain system: drain line, floor drains with trap seals, trench drain, backwater valve, cleanouts, and vents.
d. Provide sump pump system.
e. Provide natural gas piping where shown.

2. General Project Scope:
a. Plumbing system: water supply system, draining system and vent system.
b. Commission all plumbing systems as specified and as required.
c. Make sure all systems are properly inspected, tested, and placed into operation.
d. Train the Owner's personnel in the operation and maintenance of all equipment as required.
e. Provide Operation and Maintenance Manuals.
f. Provide "as-built" red lined drawings indicting final locations, routing, sizes, etc. for all plumbing equipment.

B. Clarifier Building
1. Plumbing:
a. Provide cold water lines where shown.
b. Provide a sanitary drain system: drain line, floor drains with trap seals, cleanouts, and vents.
c. Provide sump pump system.
d. Provide natural gas piping where shown.

2. General Project Scope:
a. Plumbing system: water supply system, draining system and vent system.
b. Commission all plumbing systems as specified and as required.
c. Make sure all systems are properly inspected, tested, and placed into operation.
d. Train the Owner's personnel in the operation and maintenance of all equipment as required.
e. Provide Operation and Maintenance Manuals.
f. Provide "as-built" red lined drawings indicting final locations, routing, sizes, etc. for all plumbing equipment.

1.03 INTENT:

A. The intent of this Division is to call for finished work, tested and ready for operation.

B. Furnish all materials, supplies, equipment, tools, transportation and facilities, and perform all labor and services necessary for the complete installation of the mechanical systems as shown on the drawings, as herein specified, and as required to make complete and operating systems.

C. The work shall also include the completion of such details of mechanical work not mentioned or specifically shown, but which are necessary for the successful operation of all mechanical systems.

1.04 CODES:

A. Where Standards or Codes are mentioned, the latest edition or revision in force shall be followed.

B. Contract Documents shall take precedence when they are more stringent than codes, ordinances, standards, and statutes. Codes, ordinances, standards, and statutes shall take precedence when they are more stringent or conflict with the drawings and specifications.

C. Should any change be required to conform to the codes, ordinances and rules, the Contractor shall notify the Engineer and shall include the costs involved in this work. Contractor shall be held to complete all work necessary to meet these local code requirements without additional compensation after award of the contract.

1.05 PERMITS AND INSPECTIONS:

A. Secure and pay for all permits, inspections, tests, and fees required for the work to be performed.

B. Upon completion of the work, furnish Inspection Certificates as normally issued in connection with the work.

1.06 DRAWINGS AND SPECIFICATIONS:

A. Schedules shown on drawings are for convenience and not intended to be a count of equipment, fixtures, etc. Each supplier shall make a separate count of these items and shall be required to furnish the equipment, fixture and materials wherever shown on the drawings but not included in the Schedule.

B. Drawings show arrangement, general design and extent to the systems and are diagrammatic except where in certain cases they are detailed giving exact locations and arrangement.

C. Drawings are not intended to be scaled for rough-in dimensions. Where shop drawings are required for this purpose or field measurements are needed for the installation, they shall be prepared by the installing contractor.

1.07 SUBMITTALS:

A. Submit under provisions of Division 1.

B. Shop Drawings: Prior to delivery of any material to the job site, the Contractor shall submit shop drawings for review to the Engineer.

C. Operating and Maintenance Instructions:
1. Upon completion of all work and tests, instruct the Owner in the operation and maintenance of all components.
2. Furnish sets of written Operation and Maintenance Data.

1.08 RECORD DRAWINGS:

A. The Contractor shall be responsible to maintain a complete and accurate set of marked up drawings during construction per Data per specifications in Division 1. Markups shall record any and all changes or deviations from the contract drawings.

B. Record drawings shall be delivered to the Engineer after completion of the work as a permanent record of the installation as actually constructed.

1.09 CONTRACTOR RESPONSIBILITY:

A. Each Contractor shall be responsible for the safety and good condition of all work and materials in contract until its completion.

B. Assume entire responsibility for all the materials, workmanship and satisfactory performance of the systems installed. It is not intended to limit or restrict the Contractor to the use of materials and manner of shop fabrication or erection that is not in accord with best standard practice.

C. It is also not intended that the drawings or this specification indicate or specify each item or material which is required to complete a satisfactory installation. Where such items are required and they are considered to be the accepted trade practice to provide same, they shall be considered to be both specified and indicated.

D. The design and construction of all equipment and materials specified herein shall conform in all details with the latest revised codes of the American Society of Mechanical Engineers, the American Standards Association, and all existing laws, ordinances, and requirements of the State.

1.10 DELIVERY, STORAGE AND HANDLING:

A. Protect all materials and equipment during delivery and during storage on site. Store materials and equipment on suitable blocking to maintain parts clear of the ground and to insure drainage of all rainwater.

1.11 COORDINATION AND COOPERATION:

A. Submit to and obtain from trades concerned, copies of shop drawings and catalog data of work which connects with or affects their work.

B. Make arrangements with other trades as required to properly correlate installation into the overall project.

C. Each Contractor shall be responsible for establishing elevations and routing of ductwork and piping and to correlate the work with other trades.

D. Coordinate location and arrangement of equipment, piping, ductwork, etc. In case of interferences between various items, or if simplified construction procedures are possible by relocation or changes in arrangement, change may be made if approved by the Engineer in writing.

1.12 WARRANTY:

A. Warranty all labor, materials, and workmanship for a period of one (1) year from date of final acceptance.

B. Alterations, repairs, or replacement of defects in materials, equipment, and labor shall be borne by the Contractor at Contractor's expense.

1.13 MAINTENANCE AND SERVICE ACCESSIBILITY:

A. Install equipment and piping to permit service and maintenance to all parts of the systems installed. Minor deviations from the drawings may be made to provide proper accessibility, but any major change will require written approval.

1.14 UTILITY CONNECTIONS:

A. Contractor to include a $7,000.00 allowance within their base bid to pay for a new gas service and meter to the headworks building as well as to relocate the existing gas meter at the clarifier building. Only the paid invoices from the Utility Company for upgrades to the service and meter are to be deducted from the allowance. A change order will be written adjusting the base contract +/- upon submission (marked paid) of the utility invoices.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Reference applicable technical sections in this division for specific systems.

2.02 MATERIALS, EQUIPMENT AND WORKMANSHIP:

A. All materials shall be new and shall be prepared, fabricated, and installed with skill and workmanship as is commonly considered to be the best in the trade involved. Work shall be performed at such times as will be best for the proper conduct of the entire project.

B. The Engineer shall notify the Contractor of rejected or faulty work upon discovery, but this failure to detect omissions or violations of the contract will not act as a waiver of the right to demand correction of defects in materials or workmanship.

C. Certain materials and equipment are specified by manufacturer or trade name and catalog or model number to establish standards of quality, performance, design, and suitability for intended use. The products of other manufacturers may be authorized by the Engineer if they are equivalent to those specified and so approved in writing by the Engineer.

D. If the Contractor provides equipment or materials other than that upon which the design is based, it shall be Contractor's responsibility to coordinate its installation with the work of all other trades and with the space available. Contractor shall also pay for any changes caused to other trades as a result of the substitution.

2.03 SUPPORTS:

A. Provide the supports and hangers for piping installed under this work.

2.04 COMPONENTS AND REVISIONS:

A. Components normally furnished with equipment shall be considered as part of the specification whether specifically mentioned or not. Any revision necessary due to substitution shall be the responsibility of the Contractor without extra cost to the project.

PART 3 - EXECUTION

3.01 EXAMINATION OF PREMISES:

A. Verify site conditions under which this work must be conducted prior to commencing. Contractor shall be held to have examined the premises and shall be satisfied and fully conversant with all conditions. No claim for additional compensation due to Contractor's failure to make this evaluation are allowed.

B. Examine all spaces, surfaces, and areas to receive the work. Do not proceed until corrections, if any required, have been made.

C. Verify dimensions, elevations, grades and obtain all measurements required for proper execution of the work.

D. Verify points of connections to utilities prior to start of construction and report any inconsistency before commencing work.

3.02 INSTALLATION REQUIREMENTS:

A. Each sub-contractor shall have in charge of work a competent, experienced superintendent who shall be qualified for the work to be performed.

B. Coordinate and schedule the work with other trades to properly expedite the completion of the project. Consult with other trades so that they are informed for coordination of all services.

C. Equipment shall be set in place when necessary prior to enclosing the spaces. Any equipment which will not enter the normal openings provided or which will not fit into the designated areas will not be acceptable.

D. Flush piping, valves, strainers, and similar devices. Adjust systems for proper operation.

E. Perform system adjustments and place all equipment in operating condition. Obtain the services of approved factory trained technicians where specified in this division to start the equipment in accordance with factory recommendations.

3.03 CLEARANCES:

A. Mechanical equipment shall be installed so maintenance and replacement can be performed without the removal of other equipment.

B. Clearance around equipment, meters, valves, etc., shall be provided for operation, maintenance, replacement, repair, and removal.

C. Piping connections to equipment shall be made with valves, unions, or flange fittings to permit their repair or removal without causing damage to piping or equipment.

D. Install all ducts, piping, conduit, wiring, switches, panels, fixtures, etc. to accommodate any obstacles anticipated or encountered during construction. Determine exact route and location of ductwork, piping or raceway prior to fabrication.

E. Prior to shop fabrication of ductwork, piping, conduit, etc., make field measurements and make shop drawings to check for clearances and interferences.

F. Due to the scale of drawings, all required fittings, offsets, elevation changes, and routing are not shown. The intent of these drawings and specifications is that these shall be installed without additional cost.

G. Maintain proper headroom and pitch of lines.

3.04 OPENINGS:

A. Provide openings in walls, ceilings, floors or roofing as required for the installation of the work.

B. The location and size of all openings shall be the responsibility of each subcontractor for the trade involved.

C. Install and provide sleeves, inserts, panels, raceways, boxes, curbs, etc., ahead of the work to be performed.

D. Openings shall be neatly patched after installation of the work.

E. Flash and counterflash where mechanical equipment passes through waterproofed walls, floors, and roofs.

3.05 GENERAL CLEANING:

A. Upon completion of the work, leave all surfaces broom clean and vacuum all ductwork, piping, conduit external surfaces.

B. The entire installation shall be thoroughly free from oil and grease, dust and dirt, and any other foreign matter.

C. Special cleaning methods shall be described in individual sections of this specification.

3.06 REMOVAL OF DEBRIS:

A. Remove on a daily basis all rubbish, debris, dirt, cartons, materials, etc. resulting from the work. Remove during construction to keep dirt accumulation to a minimum.

3.07 PROTECTION:

A. Protect all work from damage and protect the Owner's property from injury or loss during the performance of the work.

B. Properly protect adjacent property as provided by law and the contract documents. Provide and maintain all passageways, guard fences, lights and other facilities for protections required by local conditions.

C. Any damage shall be repaired to original condition and acceptable to the Owner.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1- GENERAL

1.01 SUMMARY:

A. This section includes the furnishing and installation of thermal insulation for the cold-water lines as indicated on the drawings, as specified herein, and as required for the proper and complete performance of the work.

B. Types of mechanical insulation specified in this Section include the following:
1. Piping Systems Insulation
a. Flexible Closed-Cell Elastomeric in a Tubular Form.

1.02 RELATED SECTIONS:

A. See Section 22 00 00 for plumbing work scope and general provisions.

1.03 SUBMITTALS:

A. Submit under provisions per Division 1.

B. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, r-factor, and furnished accessories for each mechanical system requiring insulation.

1.04 QUALITY ASSURANCE:

A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulation's similar to that required for this project.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method and UL 181. Shipping containers for insulating materials shall bear the UL label.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

1.06 WARRANTY:

A. Provide one-year material and labor warranty from the date of final acceptance.

PART 2 - PRODUCTS

2.01 PIPING INSULATION MATERIALS FOR COLD WATER PIPING

A. Subsequent references by name/model number to specific manufacturer's products are intended to indicate level of quality only.

B. Flexible elastomeric in tubular foam. AP/Armaflex. This product meets the requirements as defined in ASTM C 534, Grade 1, Type I, "Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form".

1. Materials shall have a flame spread index of less than 25 and a smoke developed index of less than 50 when tested in accordance with ASTM E84.
2. Materials shall have a maximum thermal conductivity of 0.27 Btu-in./h-ft2-°F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.
3. Materials shall have a maximum water vapor transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure A, latest revision.
4. Insulation thickness: ½".
5. Subject to compliance with requirements, provide products of one of the following:
   a. Rubatex.
   b. K-Flex.
   c. Briskheat Corp.

C. Adhesives and Finishes:
1. Adhesive shall be the insulation manufacturer's recommended contact Adhesive: Armaflex 520.
2. Insulation finish shall be the insulation manufacturer's recommended finish: WB Armaflex Finish.
3. Accessories such as adhesives, mastics and cements shall have the same properties as listed above and shall not detract from any of the system ratings as specified above.
4. Acceptable adhesives and finishes per acceptable insulation manufacturer's recommendation.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF PIPING INSULATION:

A. Install pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be adhered and sealed using Armaflex 520 Adhesive. A thin coat of adhesive must be applied to both surfaces, allowed to tack and join both surfaces with firm pressure. When using Armaflex AP only the butt joints shall be adhered using Armaflex 520 Adhesive.
B. The insulation must be installed in compression to allow for expansion and contraction. Install an additional 1.5 inches of insulation for every six feet of installed pipe or an additional 2 percent of measured pipe length.
C. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
D. Tape the ends of tubing before slipping the Armaflex or TUBOLIT pipe insulation over the new pipes to prevent dust from entering the pipe.
E. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives must be used.

3.03 PROTECTION AND REPLACEMENT:

A. Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

B. Replace damaged insulation which cannot be repaired satisfactorily including units with vapor barrier damage and moisture saturated units.

C. Remove and replace all insulating materials on which mold or mildew has occurred, or which have been discolored or stained due to mold, mildew, or condensation within 1 year of Substantial Completion.

3.04 SCHEDULES:

A. General: Insulation thickness, unless otherwise specified, shall comply with ASHRAE Standard 90A.

B. Piping:

1. Plumbing Piping Items Not Insulated: Chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drainage piping located in crawl spaces or tunnels, buried potable cold water piping, and pre-insulated equipment.

2. Cold Piping Insulation Schedule: Minimum insulation thickness for the following pipe sizes.

Service	Pipe Sizes (inches)			
	1 & less	1-1/4 - 2	2-1/2 - 4	5 & above
Domestic Cold Water	1/2"	1/2"	1/2"	1/2"

3.05 FIELD TESTS

A. Tests

1. Do not insulate piping systems until all leak and pressure testing has been performed and accepted.

B. Submittals

1. Inspect all insulation after work is complete and submit a field report that the installation work is complete.
2. After completing any punch list items resubmit field report.

END OF SECTION

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SECTION 22 10 00
BASIC PLUMBING MATERIALS & METHODS

PART 1-GENERAL

1.01 SECTION INCLUDES:

A. Basic materials, methods, and related items for plumbing.

1.02 SUBMITTALS:

A. Submit in accordance with applicable provision of Division 1.

PART 2-PRODUCTS

2.01 DOMESTIC COLD WATER SYSTEM:

A. Piping:
1. Above Ground Interior 2 Inches and Smaller: Type "L" hard drawn, seamless, copper tubing, conforming to ASTM B88. Fittings shall be sweat type wrought copper, ANSI B16.22. Tees formed into mains are not allowed.
2. Below Ground: Type "L" hard drawn, seamless, copper tubing, conforming to ASTM B88. Fittings shall be sweat type wrought copper, ANSI B16.22. Tees formed into mains are not allowed.
3. Use dielectric unions when joining dissimilar metals

B. Hose Bibbs (HB):
1. Rugged forged brass body and aluminum tee handle quarter turn hose bibb complete with vacuum breaker and quick disconnect coupling.
2. Model: Watts LFBD-QT with Watts LF8 hose connection vacuum breaker.
3. Manufacturers: Watts, Nibco, Woodford, or equal.

2.02 EFFLUENT WATER AND CITY WATER SYSTEMS:

A. Piping:
1. Above Ground Interior: 316L, seamless, stainless steel tubing, conforming to ASTM A 312 and ASTM A 778. Fittings, in the range of 1/8" to 2", shall be threaded type stainless steel. Fittings larger than 2", shall be welded type stainless steel, ASTM 403. Tees formed into mains are not allowed.

2. Below Ground: Type "L" hard drawn, seamless, copper tubing, conforming to ASTM B88. Fittings shall be sweat type wrought copper, ANSI B16.22. Tees formed into mains are not allowed.
3. Use dielectric unions when joining dissimilar metals.

B. Hose Bibbs (HB):
1. Rugged forged brass body and aluminum tee handle quarter turn hose bibb complete with vacuum breaker and quick disconnect coupling.
2. Model: Watts LFBD-QT with Watts LF8 hose connection vacuum breaker.
3. Manufacturers: Watts, Nibco, Woodford, or equal.

C. Ball Valves
1. 2-piece, full port, stainless steel ball valve. Pressure rated at 1000 psi. Adjustable stem packing. Bottom loaded, blowout proof stem. PTFE stem packing, thrust washer and body seal. Reinforced PTEF seat. Conforms to MSS-SP-110 and API-598. Acceptable manufacturers include Watts, Nibco, Conbraco Industries, or approved equal.

2.03 SANITARY AND VENT PIPING SYSTEM:

A. Piping:
   1. Buried interior soil and waste lines and exterior lines within 5 feet of building walls, cast iron soil pipe, or PVC DWV industrial drainage pipe.
      a. Cast Iron Soil Pipe: shall conform to ASTM A74, with bell and spigot type Tyler "TY-seal" joints and fittings, or CISPI Specification 301 with hubless joints and fittings, thoroughly coated inside and out with coal tar varnish and bearing the insignia of the Cast Iron Institute.
      b. Schedule 40 PVC (DWV): Pipe shall be Solid Wall, conforming to ASTM D 2665. Fittings shall be PVC socket, conforming to ASTM D 2665 for materials and ASTM D 3311 or ASTM F 1866 for dimensions. Joints shall be solvent cemented, conforming to ASTM D 2235.
   2. Above grade soil and waste lines and vent lines, cast iron soil pipe, PVC, galvanized steel pipe, or DWV industrial drainage pipe.
      a. Cast Iron Soil Pipe: Shall conform to CISPI 301 with hubless joints and fittings, thoroughly coated inside and out with coal tar varnish and bearing the insignia of the Cast Iron Institute. If soil pipe requires painting, do not apply coal tar varnish.
      b. Schedule 40 PVC (DWV): Pipe shall be Solid Wall, conforming to ASTM D 2665. Fittings shall be PVC socket, conforming to ASTM D 2665 for materials and ASTM D 3311 or ASTM F 1866 for dimensions. Joints shall be solvent cemented, conforming to ASTM D 2235.
      c. Galvanized Steel Pipe: Shall conform to ASTM A53, Type E, electric resistance welded, Grade B, Schedule 40, with screwed joints and 150 pound malleable galvanized fittings. Elbows to be long radius design. "Victaulic" type joints and fittings are acceptable.
   3. Set riser stack base fittings on a concrete or brick base on compacted soil.

B. Floor Drains (FD-1):
   1. Cast iron body, with double drainage flange, weep holes, bottom outlet, anti-tilting grate, flashing clamp, deep seal P-trap. (indicate if integral cleanout required.)
   2. Covers:
      a. Finished Areas: Adjustable, Nikaloy finish.
      b. Unfinished Areas: Non-clog 8-1/2 inch round, deep sediment bucket and satin bronze finish strainer.
   3. Acceptable Manufacturers: JR Smith, Josam, Wade, Watts, Zurn, or equal.

C. Trench Drains (TD-1):
   1. Heavy duty sloped trench drain system made from polymer concrete with ductile iron edge rails, a 4-bolt iron grate, and an inline catch basin with plastic trash bucket at outlet with ductile iron slotted heavy duty grate cover. Powerdrain Line, load class F.
   2. Acceptable Manufacturers: ACO Polymer Products or equal.

D. Drain Trap Sealer:
   1. Provide trap sealers for all floor drain traps equal to SureSeal Drain Trap Sealer conforming to ASSE 1072 and approved by the Michigan Plumbing Code.

E. Floor Cleanout (FCO)
   1. Equal to Wade, model 6000, with satin finish bronze, adjustable, and heavy duty top, secured scoriated cover no-hub outlet, adjustable ABS plastic housings, ABS plastic gasketed plug and bottom outlet.

2.04 STORM AND OVERFLOW DRAIN PIPING SYSTEMS:

A. General Storm and Overflow Drain Piping:

1. For interior sanitary, drain and vent lines that are buried, above grade horizontal, and above grade concealed vertical: use PVC DWV plastic pipe.
2. Drain, Waste, & Vent (DWV) pipe shall be solvent-cement joint PVC pipe. DWV fittings shall conform to ASTM D3311.

2.05 NATURAL GAS PIPING

A. Piping:
1. Interior Above Ground 2" and Smaller: Black steel pipe, electric resistance welded, conforming to ASTM A53, Type E, Grade B, Schedule 40, with screwed joints and 125 pound fittings. Elbows to be long radius design.
2. Interior Above Ground 2-1/2" and Larger: Black steel pipe, electric resistance welded, conforming to ASTM A53, Type E, Grade B, Schedule 40, with welded joints and fittings, except that connections to valves and equipment are made with welding neck flanges, with synthetic rubber gaskets. Elbows to be long radius design.
   a. Welding fittings for black steel pipe shall be Midwest, Tube Turn, Ladish or B&W, of domestic manufacturer, 150 pound steel beveled welding fittings conforming to ASTM A234 WPB and all applicable provisions of ANSI B16.9.
   b. Flanges for welded piping shall be 150 pound welding neck per ASTM A181 and ANSI B16.5, drilled to American Standard Template.
   c. Weldolets and Threadolets: Permitted on welded piping 3 inches and larger, for branch take-offs 1/2 the size of the main and smaller.
3. Exterior Above Ground: Pipe shall meet specifications for interior piping above. All exterior gas piping above grade shall be painted safety yellow with the following material and marked "Natural Gas":
   a. First Coat: Epoxy Mastic 5 mils D.F.T.
      1) International: Interseal 670HS.
      2) Carboline: Carbomastic 15.
      3) MAB: 101-044 Line Plymastic.
      4) I.C.I. Dulux: 224H-XXXX Devron 224 HS Epoxy High Build Coating.
   b. Second Coat: Urethane 2.0 mils D.F.T.
      1) International: Interthane 990HS.
      2) Carboline: Carboline 834.
      3) MAB: Plythane 890HS Coating.
      4) I.C.I. Dulux: 224H-XXXX Devron 224 HS Epoxy High Build Coating.

B. Valves shall be two-piece ball valves rated for oil and gas use.

2.06 BOLTS, STUDS AND NUTS:

A. Steel Bolts, Studs, and Nuts: Comply with the current ASTM A307, Grade B, or approved equal.

B. Threads: American National form right hand machine cut threads complying with the current American Standard for Screw Threads ANSI B1.1, Coarse Thread Series, and Class 2 fit.

C. Provide galvanized or cadmium plated carbon steel bolts and nuts for flanged pipe joints.

D. Provide stainless steel Type 304 bolts and nuts for underground pipe joints.

E. Bolt Heads and Nuts: Semi-finished, hexagonal, complying with the dimensions for the current American Standard for Wrench Head Bolts and Nuts and Wrench Openings, ANSI B18.2, Heavy Series.

2.07 STRAINERS:

A. Always provide ball type blow-down valve.

B. Size 2 Inch and Under: Screwed brass or iron body, Y pattern with #20 stainless steel perforated screen.

2.08 PIPE HANGERS AND SUPPORTS:

A. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inch: Adjustable stainless steel ring.

B. Hangers for Pipe Sizes 2 Inches and Above: Adjustable clevis hangers, 316 Stainless Steel.

C. Wall Support for Pipe Sizes to 3 Inches: Stainless steel hook.

D. Vertical Support: Stainless steel riser clamp.

E. Floor Support for Pipe Sizes to 4 Inches and All Cold Pipe Sizes: Stainless steel adjustable pipe saddle, locknut nipple, floor flange and concrete pier to stainless steel support.

F. Design hangers to impede disengagement by movement of supported pipe.

G. Acceptable Manufacturers: Anvil, Grinnell, and B-Line, or approved equal.

2.09 PIPE SLEEVES:

A. For pipes that pass through the building, both below and above grade:
1. Modular Mechanical Type Seal: Use LINKSEAL type pipe sleeves for the annular space between pipes and sleeves to seal against water or earth, consisting of interlocking synthetic rubber links compressed to positive seal by through bolts bearing on delrin plastic pressure plates. Provide 316 stainless steel bolts.

B. For pipes passing between non-fire rated walls or floors:
1. Material: Seamless pipe, galvanized, ASTM A53 Large enough to accommodate the pipe and its covering, wall sleeves to be flush on both sides, and floor sleeves to be extended 1 inch above floor level. Where escutcheon plates are required, extend the sleeves 1/4 inch above the floor.
2. Make watertight by means of caulking.
3. Apply anticorrosive coating to sleeves located in the Screen Room.

PART 3-EXECUTION

3.01 INSTALLATION:

A. Contractor shall provide survey to locate pipes, elevations, ducts, conduits, etc. and to prepare shop drawings. Variations to suit existing conditions, structural features or mechanical equipment shall be Contractor's responsibility.

B. Run piping parallel with building lines and as direct as possible. Piping shall be concealed as far as possible in the finished portions of the building.

C. Downfeed runouts for water piping shall be taken at 45 degrees or from bottom of main and upfeed runouts from the top of the main.

D. Cut pipe accurately and install without springing or forcing. Remove all burrs after cutting.

E. Install plumbing in compliance with applicable code requirements.

F. Install shutoff valves on all branches serving two or more outlets close to the point where the branches leave the main.

G. Provide shut-off valves and access doors for all piping installed in chases.

H. Install all supply piping for fixtures through the sidewalls unless otherwise noted on drawings.

I. Install shock absorbers on the water supply at flush valves or self-closing valves and at equipment with solenoid valves.

J. Lubricate cleanout plugs with mixture of graphite and linseed oil.

K. Install shut-off valves for all fixtures and equipment.

L. Slope sanitary and storm lines 1/8 inch per foot unless otherwise indicated.

3.02 PIPE AND FITTINGS

A. Preparation: Ream pipes and tubes, clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

B. Connection: Threaded joint steel piping up to and including 2 inches.

C. Make Threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other approved non-toxic joint compound applied to make threads only.

D. Use main sized saddle type branch connections or directly connecting branch lines to mains in steel piping if main is at least one pipe size larger than the branch for up to 6 inch mains and if main is at least two pipe sizes larger than branch for 8 inches and larger mains. Do not project branch pipes inside the main pipe.

E. Provide neoprene gasketing system for cast iron bell and spigot pipe joints.

F. Provide gasket and clamp type mechanical fastener for plain end pipe joints.

G. Clamp cast iron water pipe at fittings with 3/4 inch rods and properly anchor and support.

H. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

I. Make connections to equipment and branch mains with unions.

J. Provide non-conducting type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.

K. Do not support pipe from other pipe.

L. Use hangers that are vertically adjustable 1-1/2 inch minimum after piping is erected.

M. Place a hanger within one foot of each horizontal elbow.

N. Support vertical piping at every other floor.

O. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

P. Where practical, support riser piping independently of connected horizontal piping.

Q. Install hangers to provide minimum 1/2 inch clear space between finished covering and adjacent work.

R. Support horizontal steel and copper piping as follows:

Nominal Pipe Size (in.)	Max. Distance Between Support (ft.)
1/2 to 1-1/2	6
2 & 2-1/2	10

S. Support horizontal PVC and CPVC piping as follows:

Nominal Pipe Size (in.)	Max. Distance Between Support (ft.)
All Sizes	6

3.03 SLEEVES:

A. Refer to Part 2 – Products for applications.

B. Wherever possible, set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

C. Where piping or ductwork passes through floor, ceiling, or wall where no potential moisture exists, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

D. Install chrome plated escutcheons where piping passes through finished surfaces.

3.04 VALVES:

A. Refer to valve schedule and piping schematics on drawings for specific valve selections and applications.

B. Provide valves of same manufacturer throughout where possible.

C. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

D. Installation:
1. Install valves with stems upright or horizontal, not inverted.
2. Install gate valves for shut-off and isolating service, to isolate equipment, part of systems or vertical risers.
3. Install globe or angle valves for throttling service and control device or meter by-pass.

3.05 LUBRICATION:

A. Ensure that all motors and equipment, as required, are properly lubricated before such items are accepted by the Engineer and Owner.

3.06 PIPE AND EQUIPMENT IDENTIFICATION:

A. Label all piping showing contents and direction of flow.

B. Label all equipment.

C. Place label adjacent to each valve and branch takeoff, at each side of a wall or partition through which pipe passes, and at 20 feet 0 inch spacing on straight runs.

D. Label Manufacturers: Seton Name Plate Corporation, W.H. Brady, Topflight Tape Company, James H. Matthews, or approved equal.

E. Paint or stencil 1-1/2 inch high black enamel block type letters or numerals on all equipment items

3.07 TESTING AND CLEANING OF PLUMBING SYSTEMS:

A. General:
1. Submit a notice of intention to test to the Engineer and Owner at least seven (7) days prior to the test.
2. If desired by Engineer and Owner to witness the test, coordinate the tests to accommodate their schedules.
3. Provide pumps, gauges, instruments, test equipment personnel and clean auxiliary water.
4. Submit a complete test report to the Engineer.
5. Test prior to painting, installation and insulation, or concealment.
6. Tests may be made on sections of piping as installed.
7. Re-test repaired or revised piping.

B. Pressure Systems:
1. Domestic cold water and natural gas.
   a. Testing with compressed air or gas is prohibited except for natural gas and compressed air systems.
   b. Test Pressure: 150 percent of the operating pressure or pump shut-off head pressure whichever is greater.
   c. Minimum Pressure: 50 psi.
   d. Test Period: 2 hours minimum.

C. Gravity Systems:
1. Waste drain, and vent systems, downspouts, rain leaders and their branches.
   a. Entire System: Close all openings except the highest and fill system with water to point of overflow.
   b. Sections: Close all openings except highest and provide a head of 10 feet. In testing successive sections, at least the upper 10 feet of next preceding section shall be included so every joint and pipe in the whole system (except the uppermost 10 feet) shall have been subjected to a head of ten feet of water.
   c. After system or section under test has been filled with water, wait at least 15 minutes before starting inspection.
   d. After 2 hours (minimum) there shall be no evidence of leakage.

e. Test waste, drain and vent pipe system before fixtures are installed and retest after fixtures have been installed.

D. Cleaning of Domestic Water Systems:
1. Test and inspect water distribution piping as specified in local plumbing code.
2. Clean and disinfect water distribution piping as specified in local plumbing code. If no procedure is specified, comply with the following:
   a. Perform initial system flush and drain.
   b. Fill system with a solution mixture of 60 ppm of chlorine in water and hold for not less than a 24-hour period.
   c. Drain and flush until chlorine residue is below 0.5 AWWA specification.
   d. Repeat chlorination as necessary until accepted by authority having jurisdiction.
   e. Prepare and submit reports for all cleaning and disinfecting activities.

END OF SECTION

SECTION 23 05 00
MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 MECHANICAL WORK SCOPE SUMMARY

A. General:
1. "Provide" means furnish and install.
2. Although the drawings attempt to depict piping and equipment as installed, actual conditions and locations of existing may differ from that which is shown. Field verify actual conditions prior to bid.
3. Submit equipment and product submittals to Engineer for approval prior to construction.
4. See Section 23 05 93 - Testing, Adjusting, and Balancing for a project design narrative.

1.02 WORK SCOPE SUMMARY

A. Headworks Building:
1. Heating & Ventilation:
a. Screening / Grit Room: Provide new direct gas fired make-up air unit (MAU) for general ventilation and heat in the room. The MAU will operate continuously through an explosion proof and corrosion resistant wall mounted thermostat. Provide new roof exhaust fan for general room exhaust. This fan will be interlocked with the MAU to operate when the MAU unit is operating. The exhaust air quantity will exceed the supply air quantity by a minimum of 10% to keep the room negative to the adjacent electrical room. Ductwork in this room shall be galvanized steel, ASTM A527, coating G90, internally and externally polyvinyl (PVC) coated.
b. Electrical Room: A new supply air fan and relief / exhaust louver will operate during the summer to reduce heat buildup. A wall mounted thermostat will control the "On/Off" operate of the fan and the louver damper. A Natural Gas unit heater with a wall mounted thermostat will be used to provide heat during the winter for the electrical room. Ductwork in this room shall be galvanized steel, ASTM A527, coating G90.

2. General Project Scope:
a. Commission all HVAC systems as specified and as required.
b. Make sure all systems are properly inspected, tested and placed into operation.
c. The Mechanical Contractor shall be the primary (HVAC) commissioning agent and responsible for coordinating and scheduling, in conjunction with the Owner, all commissioning activities. Properly place all systems into operation before turning over to the Owner
d. Train the Owner's personnel in the operation and maintenance of all equipment as required.
e. Provide Operation and Maintenance Manuals.
f. Provide "as-built" red lined drawings indicting final locations, routing, sizes, etc., for all mechanical equipment.

3. HVAC Test and Balance Work
a. Contractor shall balance and verify the proper air balance in all areas as indicated on the drawings. See Section 23 05 93 - Testing, Adjusting, and Balancing for additional requirements for the Odor Control System maximum cfm rating.

B. Clarifier Building:
1. Demolition:
a. Demolish louver L-7 and motorized damper.
b. Demolish motorized damper at louver L-8

2. New Work:
   a. Relocate EF-3 as shown on plans.
   b. Provide three (3) new intake louvers and associated dampers.
   c. Provide one new exhaust louver and associated damper.
   d. Provide two (2) new gas unit heaters with associated thermostats and combustion air intake and vent ductwork. Provide concentric vent kits through roof.
   e. Provide outdoor air and exhaust air ductwork.

1.03 INTENT:

A. The intent of this division is to call for finished work, tested and ready for operation.

B. Furnish all materials, supplies, equipment, tools, transportation, and facilities, and perform all labor and services necessary for the complete installation of the mechanical systems as shown on the drawings, as herein specified, and as required to make complete and operating systems.

C. The work shall also include the completion of such details of mechanical work not mentioned or specifically shown, but which are necessary for the successful operation of all mechanical systems.

1.04 CODES:

A. Where Standards or Codes are mentioned, the latest edition or revision in force shall be followed.

B. Contract Documents shall take precedence when they are more stringent than codes, ordinances, standards, and statutes. Codes, ordinances, standards, and statutes shall take precedence when they are more stringent or conflict with the drawings and specifications.

C. Should any change be required to conform to the codes, ordinances and rules, the Contractor shall notify the Engineer and shall include the costs involved in this work. Contractor shall be held to complete all work necessary to meet these local code requirements without additional compensation after award of the contract.

1.05 PERMITS AND INSPECTIONS:

A. Secure and pay for all permits, inspections, tests, and fees required for the work to be performed.

B. Upon completion of the work, furnish Inspection Certificates as normally issued in connection with the work.

1.06 DRAWINGS AND SPECIFICATIONS:

A. Schedules shown on drawings are for convenience and not intended to be a count of equipment, fixtures, etc. Each supplier shall make a separate count of these items and shall be required to furnish the equipment, fixture and materials wherever shown on the drawings but not included in the Schedule.

B. Drawings show arrangement, general design and extent to the systems and are diagrammatic except where in certain cases they are detailed giving exact locations and arrangement.

C. Drawings are not intended to be scaled for rough-in dimensions. Where shop drawings are required for this purpose or field measurements are needed for the installation, they shall be prepared by the installing contractor.

1.07 SUBMITTALS:

A. Submit under provisions of Division 1.

B. Shop Drawings: Prior to delivery of any material to the jobsite, the Contractor shall submit shop drawings for review to the Engineer.

C. Operating and Maintenance Instructions:
1. Upon completion of all work and tests, instruct the Owner in the operation and maintenance of all components.
2. Furnish sets of written Operation and Maintenance Data.

1.08 RECORD DRAWINGS:

A. The Contractor shall be responsible to maintain a complete and accurate set of marked up drawings during construction per Data per specifications in Division 1. Markups shall record any and all changes or deviations from the contract drawings.

B. Record drawings shall be delivered to the Engineer after completion of the work as a permanent record of the installation as actually constructed.

1.09 CONTRACTOR RESPONSIBILITY:

A. Each Contractor shall be responsible for the safety and good condition of all work and materials in Contract until its completion.

B. Assume entire responsibility for all the materials, workmanship and satisfactory performance of the systems installed. It is not intended to limit or restrict the Contractor to the use of materials and manner of shop fabrication or erection that is not in accord with best standard practice.

C. It is also not intended that the drawings or this Specification indicate or specify each item or material which is required to complete a satisfactory installation. Where such items are required and they are considered to be the accepted trade practice to provide same, they shall be considered to be both specified and indicated.

D. The design and construction of all equipment and materials specified herein shall conform in all details with the latest revised codes of the American Society of Mechanical Engineers, the American Standards Association, American Society of Heating, Refrigeration, and Air Conditioning Engineers, and all existing laws, ordinances and requirements of the State.

1.10 DELIVERY, STORAGE AND HANDLING:

A. Protect all materials and equipment during delivery and during storage onsite. Store materials and equipment on suitable blocking to maintain parts clear of the ground and to insure drainage of all rainwater.

1.11 COORDINATION AND COOPERATION:

A. Submit to and obtain from trades concerned, copies of shop drawings and catalog data of work which connects with or affects their work.

B. Make arrangements with other trades as required to properly correlate installation into the overall project.

C. Each Contractor shall be responsible for establishing elevations and routing of ductwork and piping and to correlate the work with other trades.

D. Coordinate location and arrangement of equipment, piping, ductwork, etc. In case of interferences between various items, or if simplified construction procedures are possible by relocation or changes in arrangement, change may be made if approved by the Engineer in writing.

1.12 WARRANTY:

A. Warranty all labor, materials, and workmanship for a period of one (1) year from date of final acceptance.

B. Alterations, repairs, or replacement of defects in materials, equipment, and labor shall be borne by the Contractor at Contractor's expense.

1.13 MAINTENANCE AND SERVICE ACCESSIBILITY:

A. Install equipment, ductwork and piping to permit service and maintenance to all parts of the systems installed. Minor deviations from the drawings may be made to provide proper accessibility, but any major change will require written approval.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Reference applicable technical sections in this division for specific systems and / or drawing schedules.

2.02 MATERIALS, EQUIPMENT AND WORKMANSHIP:

A. All materials shall be new and shall be prepared, fabricated, and installed with skill and workmanship as is commonly considered to be the best in the trade involved. Work shall be performed at such times as will be best for the proper conduct of the entire project.

B. The Engineer shall notify the Contractor of rejected or faulty work upon discovery, but this failure to detect omissions or violations of the contract will not act as a waiver of the right to demand correction of defects in materials or workmanship.

C. Certain materials and equipment are specified by manufacturer or trade name and catalog or model number to establish standards of quality, performance, design, and suitability for intended use. The products of other manufacturers may be authorized by the Engineer if they are equal to those specified and so approved in writing by the Engineer.

D. If the Contractor provides equipment or materials other than that upon which the design is based, it shall be Contractor's responsibility to coordinate its installation with the work of all other trades and with the space available. Contractor shall also pay for any changes caused to other trades as a result of the substitution.

2.03 EQUIPMENT SUPPORTS:

A. Provide the supports and hangers for equipment installed under this work. Where equipment is to be suspended from the roof steel, provide intermediate support members such that the load is carried at the panel points of the joists or trusses.

2.04 COMPONENTS AND REVISIONS:

A. Components normally furnished with equipment shall be considered as part of the specification whether specifically mentioned or not. Any revision necessary due to substitution shall be the responsibility of the Contractor without extra cost to the project.

PART 3 - EXECUTION

3.01 EXAMINATION OF PREMISES:

A. Verify site conditions under which this work must be conducted prior to commencing. Contractor shall be held to have examined the premises and shall be satisfied and fully conversant with all conditions. No claim for additional compensation due to Contractor's failure to make this evaluation are allowed.

B. Examine all spaces, surfaces, and areas to receive the work. Do not proceed until corrections, if any required, have been made.

C. Verify dimensions, elevations, grades and obtain all measurements required for proper execution of the work.

D. Verify points of connections to utilities prior to start of construction and report any inconsistency before commencing work.

3.02 INSTALLATION REQUIREMENTS:

A. Each subcontractor shall have in charge of work a competent, experienced superintendent who shall be qualified for the work to be performed.

B. Coordinate and schedule the work with other trades to properly expedite the completion of the project. Consult with other trades so that they are informed for coordination of all services.

C. Equipment shall be set in place when necessary, prior to enclosing the spaces. Any equipment which will not enter the normal openings provided or which will not fit into the designated areas will not be acceptable.

D. Equipment shall be cleaned, aligned to tolerances specified by equipment manufacturer, and lubricated prior to start-up. Flush piping, valves, strainers, and similar devices. Adjust systems for proper operation.

E. Perform system adjustments and place all equipment in operating condition. Obtain the services of approved factory trained technicians where specified in this division to start the equipment in accordance with factory recommendations.

3.03 CLEARANCES:

A. Mechanical equipment shall be installed so maintenance and replacement can be performed without the removal of other equipment.

B. Clearance around fans, etc. shall be provided for operation, maintenance, replacement, repair and removal.

C. Install all ducts, piping, conduit, wiring, switches, panels, fixtures, etc., to accommodate any obstacles anticipated or encountered during construction. Determine exact route and location of ductwork, piping or raceway prior to fabrication.

D. Prior to shop fabrication of ductwork, piping, conduit, etc., make field measurements and make shop drawings to check for clearances and interferences.

E. Due to the scale of drawings, all required fittings, offsets, elevation changes, and routing are not shown. The intent of these drawings and specifications is that these shall be installed without additional cost.

F. Maintain proper headroom and pitch of lines.

3.04 OPENINGS:

A. Provide openings in walls, ceilings, floors or roofing as required for the installation of the work.

B. The location and size of all openings shall be the responsibility of each subcontractor for the trade involved.

C. Install and provide sleeves, inserts, panels, raceways, boxes, curbs, etc., ahead of the work to be performed.

D. Openings shall be neatly patched after installation of the work.

E. Flash and counterflash where mechanical equipment passes through waterproofed walls, floors, and roofs.

3.05 GENERAL CLEANING:

A. Upon completion of the work, leave all surfaces broom clean and vacuum all ductwork, piping, conduit external surfaces.

B. The entire installation shall be thoroughly free from oil and grease, dust and dirt, and any other foreign matter.

3.06 REMOVAL OF RUBBISH:

A. Remove on a daily basis all rubbish, debris, dirt, cartons, materials, etc., resulting from the work. Remove during construction to keep dirt accumulation to a minimum.

3.07 PROTECTION:

A. Protect all work from damage and protect the Owner's property from injury or loss during the performance of the work.

B. Properly protect adjacent property as provided by law and the contract documents. Provide and maintain all passageways, guard fences, lights and other facilities for protections required by local conditions.

C. Any damage shall be repaired to original condition and acceptable to the Owner.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 SUMMARY:

A. This section specifies the requirements and procedures for total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of mechanical systems air flow rates as required to meet design specifications; and recording and reporting the results of these measurements.

B. Systems testing, adjusting, and balancing (T/A/B) consists of checking and adjusting all building environmental systems to produce design objectives includes, but is not necessarily limited to, the following:
1. Balancing of air distribution.
2. Adjustment of total system to provide design flow rates.
3. Electrical measurements.
4. Verification of performance of all equipment and automatic controls.
5. Sound and vibration measurement.

C. Test, adjust, and balance the following mechanical systems:
1. Exhaust and Ventilation Fans and Damper Positions
2. Mechanical air handling unit (MAU) and damper positions.
3. Verify control system operation.

D. This section does not include:
1. Testing pressure vessels for compliance with safety codes.
2. Specifications for materials for patching mechanical systems.
3. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
4. Requirements and procedures for piping and ductwork systems leakage tests.

1.02 DEFINITIONS:

A. Test: To determine quantitative performance of equipment.

B. Adjust: To regulate the specified air flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).

C. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

D. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

E. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

1.03 SUBMITTALS:

A. Submit product data under provisions of Division 1.

B. Reports: Submit T/A/B reports to be proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are true representation of how the systems are operating at the completion of the T/A/B procedures; and are an

accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

C. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within period of 6 months prior to starting the project.

1.04 QUALITY ASSURANCE:

A. Codes and Standards: Perform T/A/B work in accordance with applicable provisions of the following:
   1. AABC: "National Standards for Total System Balance".
   2. ASHRAE: ASHRAE Handbook, 1995 Applications Volume, Chapter 34, Testing, Adjusting, and Balancing.

1.05 PROJECT CONDITIONS:

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING:

A. Before operating the system, perform these steps:
   1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
   2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply and exhaust) and temperature control diagrams.
   3. Compare design to installed equipment and field installations.
   4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
   5. Check dampers for correct and locked position, and temperature control for completeness of installation before starting fans.
   6. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare summation of required outlet volumes to permit crosscheck with required fan volumes.
   7. Place outlet dampers in the fully open position.
   8. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
   9. Lubricate all motors and bearings.
   10. Check fan belt tension.
   11. Check fan rotation.

3.02 MEASUREMENTS:

A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.

B. Provide instruments meeting the specifications of the referenced standards.

C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.

D. Apply instrument as recommended by the manufacturer.

E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

F. When averaging values, take sufficient quantity of readings which will result in repeatability error of less than 5 percent. When measuring single point, repeat readings until 2 consecutive identical values are obtained.

G. Take all reading with the eye at the level of the indicated value to prevent parallax.

H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.

I. Take measurements in the system where best suited to the task.

3.03 PERFORMING TESTING, ADJUSTING, AND BALANCING:

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.

C. Patch insulation, ductwork, and housings, using materials identical to those removed.

D. Seal ducts and piping, and test for and repair leaks.

E. Mark equipment settings, including damper control positions and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

F. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.04 RECORD AND REPORT DATA:

A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.

B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

END OF SECTION

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SECTION 23 09 93
SEQUENCES OF OPERATION

PART 1 – GENERAL

1.01 SECTION INCLUDES:

A. Sequences of Operation for Exhaust Fans, Louver Dampers, and Unit Heaters.

1.02 GENERAL

A. Provide Temperature Control work as shown on the drawings and as described in the specifications.

1.03 RELATED SECTIONS:

A. Section 23 05 00 - Mechanical General Provisions

B. Section 23 05 93 - Testing, Adjusting, and Balancing

C. Section 26 05 00 - Electrical General Provisions

1.04 SUBMITTALS:

A. Submit under provisions of Division 1.

PART 2: - PRODUCTS

2.01 GENERAL

A. See Division 26 for products and installation methods.

B. The requirements of this section shall serve as part of the work scope and contract obligations of the Mechanical. Except as specifically noted, the mechanical contractor shall provide all products required to perform the specified sequences of operations, whether or not the products are shown on the drawings.

C. Thermostats shall be supplied by mechanical contractor and installed and wired by the electrical contractor.

PART 3: - EXECUTION

3.01 SEQUENCE OF OPERATION OF EQUIPMENT

A. Headworks Building
   1. Grit and Screen Room: MAU -1 and EF -1 shall operate as follows:
      a. Make-Up-Air Unit MAU-1 and Exhaust Fan EF-1 when energized shall operate continuous 24 hours of the day 7 days a week all year to provide the required ventilation rate of 12 air changes per hour (ACH).
      b. MAU-1 is activated / deactivated manually through its control panel. Once enabled, the unit will operate under its own factory controls.
      c. Motorized damper (MD-1) integral to the MAU will drive the blades "OPEN". The supply fan will operate for a period of 2 minutes to purge the unit of any flammable gases. Following the 2 minute purge cycle, the supply fan shall remain activated and the direct fired gas burn will be allowed to be energized. Once the burner is operational, the discharge air thermostat will modulate the gas flow to the burner to maintain the adjustable setting of the thermostat. The room temp sensor / thermostat will reset discharge air temperate up or down to satisfy the setting of the room temp sensor. The MAU will operate under its own factory controls.
      d. Once MAU-1 and the supply air is confirmed, EF-1 shall be enabled through a contact in the MAU control panel. EF-1 shall remain energized and operate as long as air flow from MAU-1 is maintained.

e. MAU-1 control panel will have factory contacts as follows:
   1.) General alarm (to SCADA)
   2.) Auto status (to SCADA)
   3.) Run status (to EF-1 starter)
   4.) Run status (to SCADA)

2. Electrical Room Heat and Ventilation: SAF-1, L-2, L-3, and UH-1 shall operate as follows:
   a. Wall mounted cooling only, 120V thermostat will energize SAF-1 to maintain maximum space temperature (adjustable) at set point, 80F.
   b. As SAF-1 is energized, electric damper actuator MD-2 on louver L-2 will drive the damper blades to their OPEN position. At the same time, electric damper actuator MD-3 on louver L-3 will be energized.
   c. When the space temperature is reduced and the thermostat setting is satisfied, SAF-1 is de-energized, damper actuators MD-2 on louver L-2 and MD-3 on louver L-3 will be de-energized and will spring to their CLOSED position.
   d. Gas Unit Heater, UH-1, will cycle on or off during the heating season to maintain the (adjustable) temperature set point of the wall mounted thermostat at 55F.

B. Clarifier Building
   1. North Clarifier Room
      a. See section 15985 – Sequence of Operations from the Wastewater Treatment System Improvements in the year 2000.
      b. EF-3 (existing) to be paired with L-17 (new). EF-3 sequence to remain the same.
      c. EF-4 (existing) to be paired with L-7 (new). EF-4 sequence to remain the same.
   2. South Clarifier Room
      a. Exhaust fan EF-6 when energized shall operate continuous 24 hours of the day 7 days a week all year to provide the required ventilation rate of 12 air changes per hour (ACH). Louver L-15 motorized damper shall open when EF-4 is energized.
      b. Gas Unit Heaters, UH-1 and UH-2, will cycle on or off during the heating season to maintain the (adjustable) temperature set point of the wall mounted thermostat at 55F.

END OF SECTION

SECTION 23 10 00
BASIC HVAC MATERIALS & METHODS

PART 1-GENERAL

1.01 SECTION INCLUDES:

A. Basic materials, methods and related items for heating and ventilation.

1.02 SUBMITTALS:

A. Submit in accordance with applicable provision of Division 1.

PART 2-PRODUCTS

2.01 BOLTS, STUDS AND NUTS:

A. Steel Bolts, Studs, and Nuts: Comply with the current ASTM A307, Grade B, or approved equal.

B. Threads: American National form right hand machine cut threads complying with the current American Standard for Screw Threads ANSI B1.1, Coarse Thread Series, and Class 2 fit.

C. Bolt Heads and Nuts: Semi-finished, hexagonal, complying with the dimensions for the current American Standard for Wrench Head Bolts and Nuts and Wrench Openings, ANSI B18.2, Heavy Series.

2.02 HANGERS AND SUPPORTS:

A. Provide fans with manufacturer spring vibration isolators; if located in the Screen Room, these shall be corrosion resistant.

B. Provide manufacturer recommended hangers and brackets for fans and unit heaters; if located in the Screen Room, these shall be corrosion resistant.

C. Provide threaded rod hangers and supports for ductwork; if located in the Screen Room, these shall be corrosion resistant.

2.03 DUCT SLEEVES:

A. For ducts passing between non-fire rated floors:

1. Material: Heavy gauge galvanized sheet metal or galvanized structural angle large enough to accommodate the duct. Floor sleeves to be extended 1 inch above floor level.
2. Make watertight by means of caulking.
3. Apply anticorrosive coating to sleeves located in the Screen Room.

PART 3-EXECUTION

3.01 INSTALLATION:

A. Contractor shall provide survey to locate pipes, elevations, ducts, conduits, etc. and to prepare shop drawings. Variations to suit existing conditions, structural features or mechanical equipment shall be Contractor's responsibility.

B. Route ductwork parallel with building lines and as direct as possible.

3.02 SLEEVES:

A. Refer to Part 2 – Products for applications.

B. Wherever possible, set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

C. Where ductwork passes through floor or wall where no potential moisture exists, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

3.03 LUBRICATION:

A. Ensure all motors and equipment, as required, are properly lubricated before such items are accepted by the Engineer and Owner.

3.04 EQUIPMENT IDENTIFICATION:

A. Label all equipment.

B. Label Manufacturers: Seton Name Plate Corporation, W.H. Brady, Topflight Tape Company, James H. Matthews, or approved equal.

C. Paint or stencil 1-1/2 inch high black enamel block type letters or numerals on all equipment items

END OF SECTION

SECTION 23 33 00
DUCTWORK AND DUCTWORK ACCESSORIES

PART 1 – GENERAL

1.01 GENERAL WORK SUMMARY:

A. Work of this section includes ductwork and ductwork accessories.

B. Submit product data under provisions of Division 1

PART 2 - PRODUCTS

2.01 DUCTWORK AND ACCESSORIES:

A. Duct sizes shown on drawings are inside clear dimensions. Construct all ductwork as shown in the SMACNA duct manual.

B. SCREEN / GRIT ROOM DUCTWORK
1. Duct shall be galvanized sheet steel, ASTM A527, coating G90, coated before fabrication with four mil dry film thickness of polyvinyl chloride (PVC) plastic suitable for temperature to 120°C (250°F). Material shall comply with UL 181, Class 1 (flame spread rating of not more than 25 and a smoke developed rating of 50 or less in accordance with ASTM E84). Provide compatible joint sealant and material for field coating of damaged areas.
2. 4x4 PCD Polyvinyl Coated Duct: Duct internally and externally coated with PVC,
3. Provide polyvinyl chloride (PVC) coated access doors with cam locks and neoprene gasketing of a size as called out in the drawings. Doors shall be pressure rated for the intended service, negative or positive pressure. Manufacturer: Ruskin or approved equal
4. All hangers and supports shall be PVC coated or 316 Stainless Steel

C. ELECTRICAL ROOM DUCTWORK
1. Duct shall be galvanized sheet steel, ASTM A527, coating G90.
2. Provide access doors with cam locks and neoprene gasketing of a size as called out in the drawings. Doors shall be pressure rated for the intended service, negative or positive pressure. Manufacturer: Ruskin or approved equal.

D. CLARIFIER ROOM DUCTWORK
1. Duct shall be galvanized sheet steel, ASTM A527, coating G90.
2. Provide access doors with cam locks and neoprene gasketing of a size as called out in the drawings. Doors shall be pressure rated for the intended service, negative or positive pressure. Manufacturer: Ruskin or approved equal.

E. Joint and seams for rectangular ducts and transformations are at least one gauge heavier than the duct material and all laps to be in the direction of air flow. No sheet metal screws used in the joining or fabrication of ducts when it is possible to use rivets and bolts. All edges and slips finished smooth inside the ducts. Joints and seams air tight.

F. All ducts braced and stiffened so as not to breathe, rattle, vibrate or sag. The bracing applied to the outside of all ducts same as shown in said schedule, and may consist of standing seams, modified S slips or angles, and cross breaking supplemented by angle stiffener. All ducts adequately supported at not greater than 5 foot intervals. Ducts up to 29 inches maximum side, hung by steel straps, 1 inch x 1/8 inch gauge. Larger ducts supported by 1/4 inch threaded rods and angle iron trapeze.

G. All exhaust and transfer duct shall be considered low pressure and shall be fabricated according to SMACNA standards for +/- 2 inches positive or negative pressure.

However, seal all transverse joints, longitudinal seams, and duct penetrations per SMACNA Seal Class A.

H. All galvanized steel ductwork including PCD coated shall be constructed and installed in accordance with SMACNA "HVAC Duct Construction Standards". Use Tables 1-3 through 1-19, including their associated details, for rectangular ductwork. Use Sections 3.1 and 3.2 for round ductwork. Conform to the requirements in the reference standard for metal thickness, reinforcing types and intervals, and joint types and support intervals. When flanged type connections are required, use Type TDF with 6 inch metal cleats and bolted flange connections at each corner, and with neoprene gaskets in all locations.

I. Duct hangers and supports Interior hanger spacing shall not exceed 8 feet. Interior hanger rods shall be constructed of hot-dipped galvanized steel.

J. Duct test holes - Provide test wells, holes in ducts as required for TAB procedures. Cap openings with neoprene plugs.

K. Flexible connections - Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

PART 3 - INSTALLATION

3.01 INSTALLATION:

A. Install all items in accordance with manufacturer's instructions.

B. Install in first class and workmanlike manner, true to the dimensions indicated on the drawings, straight and smooth on the inside and with airtight joints.

C. All exhaust and transfer air duct shall be fabricated SMACNA standards for +/- 2 inches negative pressure. Seal all transverse joints, longitudinal seams, and duct penetrations per SMACNA Seal Class A.

END OF SECTION

SECTION 23 34 00
FANS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Work of this section includes an inline exhaust fan and fiberglass roof exhaust fan..

1.02 RELATED SECTIONS:

A. Testing, Adjusting and Balancing - Section 23 05 93.

B. Sequences of Operation - Section 23 09 93.

1.03 SUBMITTALS:

A. Submit product data for the exhaust fans and supply fan under provisions of Division 1.

PART 2 - PRODUCTS

2.01 General:

A. Provide fans of the type, size and capacity indicated on drawings.

B. Fans shall be manufactured at an ISO 9001 certified facility and be listed by Underwriters Laboratories (UL 705). Fans shall bear the AMCA certified ratings seal for sound and air performance.

C. Provide fan curve and sound data with shop drawing submittal.

D. Motor shall be furnished at the specified voltage, phase, and enclosure.

E. Provide accessories as specified on the drawings and as required for a complete installation.

F. Acceptable manufacturers: Flo-Aire, Hartzell, Greenheck, Cook, or approved equal as determined by the Engineer prior to bids.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install in accordance with manufacturers' recommendations.

B. After the heating and ventilating systems are operable, make adjustments to the systems to deliver design air quantities.

C. Provide supports as required to suspend from roof structure or floor.

D. Submit equipment start-up report.

END OF SECTION

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SECTION 23 37 00
AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

1.02 REFERENCES

A. AAMA 2604 High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AAMA 2605 - High Performance Organic Coatings on Architectural Extrusions and Panels.

C. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

D. AMCA 511 - Certified Ratings Program for Air Control Devices.

E. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. ASTM D822 - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

I. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

J. ASTM D2244 - Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

1.03 SUBMITTALS

A. Submit under provision of Division 1.
   1. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission.
   2. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
   3. Indicate all accessories and finishes.

B. Submit product data for the following items:
   1. Registers, Diffusers, and Grilles.
   2. Stationary Louvers.
   3. Motorized Dampers.

1.04 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.
B. Test and rate louver performance in accordance with AMCA 500.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. Protect materials and finishes during handling and installation to prevent damage.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

A. Manufacturer shall provide standard limited warranty for louver systems for a period of 1 year from date of installation, no more than 18 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the Owner.

PART 2 - PRODUCTS

2.01 REGISTERS, GRILLES, AND DIFFUSERS:

A. See schedules on drawings.
B. Allowable manufacturers:
   1. Kees
   2. Titus
   3. Price
   4. Other manufacturers as determined equal by the engineer prior to bid.

2.02 STATIONARY LOUVERS

A. See schedules on drawings.

B. Provide accessory motorized dampers and damper actuators as schedules on the drawings.

C. Provide accessory backdraft dampers as schedules on the drawings.

D. Allowable Manufacturers:
   1. Ruskin
   2. Greenheck
   3. Carnes
   4. Other manufacturers as determined equal by the engineer prior to bid.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

B. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean opening thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install all items in accordance with manufacturer’s instructions.

B. Install in first class and workmanlike manner, true to dimensions indicated on the drawings, straight and smooth on the inside, and with airtight joints.

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3.04 CLEANING

A. Clean louver surfaces in accordance with manufacturer's instructions.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 23 74 23
PACKAGED MAKE-UP AIR UNITS

PART 1 –GENERAL

1.01 SECTION INCLUDES:

A. Provide vertical, interior 100% Outside air Direct Fired Make-up Air unit (MAU) for heating and ventilation.

1.02 RELATED SECTIONS:

A. Section 23 05 00 - Mechanical General Provisions.

B. Section 23 09 93 - Sequence of Operations.

1.03 SUBMITTALS:

A. Submit under provisions of Division 1.

B. Product Data: Include rated capacities, furnished specialties, and accessories.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following:
   1. Wiring Diagrams: Power, signal, and control wiring.

D. Startup service reports. At time of shipment provide copies of factory start-up and testing reports for each unit.

E. Operation and Maintenance Data: For direct-fired heating and ventilating units to include in emergency, operation, and maintenance manuals.

F. Warranty: Provide a complete warranty statement.

G. Submittals Required for Closeout:
   1. Startup reports
   2. Owner training sign-in sheets.
   3. Warranties - Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with the manufacturer.
   4. As-built drawings, O&M manuals, etc., to be submitted by installing contractor.
   5. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
      a. Filters: Two set(s) filters.

1.04 QUALITY ASSURANCE:

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with a minimum of ten years documented experience. Equipment shall be the standard product of the manufacturer and shall have complete cataloged data.

B. Installer Qualifications: All installation and service of direct fired air handlers must be performed by a contractor qualified in the installation and service of said products with proof of a minimum of three years documented experience.

C. Factory Testing: Each air handler shall be factory-tested. Testing shall consist of checking all circuits for continuity, operability of all valves, control motors, fan speed, linkages, switches and burner.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Conform to ANSI Standards Z83.18 or Z83.4 (latest version) and provide evidence that the air handler and its control system have been found in compliance as a system with these standards by nationally recognized testing laboratory.

F. Conform to NFPA 90.

G. Conform to the National Fuel Gas Code (NFPA 54 / ANSI Z223.1).

H. Comply with NFPA 70.

I. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and Startup."

J. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 "Heating, Ventilating, and Air-Conditioning."

K. Unit must comply and be built in conformance with NFPA-54, ETL/UL design certified, and listed to ANSI Z83.18b-2008 standards.

L. Burners shall be designed to not exceed the contaminant threshold limits as established by OSHA and ACGIH.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

1.06 WARRANTY:

A. Parts warranty of twenty-four (24) months from the date of purchase by Buyer or twenty-seven (27) months from date of shipment by seller, whichever occurs first.

B. Labor warranty for removing and/or re-installing replacement parts shall be included for a period of 30 days from field start-up or 90 days from shipment, whichever comes first.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide MAU as specified here in and as scheduled on the drawings.

2.02 ACCEPTABLE MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. BASIS OF DESIGN: AbsolutAire AA Series. The following manufacturers are allowed to bid providing they exceed or meet all conditions as shown in the Specification, Plans, and Schedules as determined by the Engineer:
2. Jackson & Church.
3. Rapid Engineering.
4. Reznor-Thomas & Betts Corporation; Mechanical Products Division.

B. If the Contractor wishes to substitute equipment they shall be responsible for the cost of any and all changes that may affect other trades.

2.03 DIRECT FIRED MAKE-UP AIR UNIT:

A. Packaged Units: Factory-assembled, pre-wired, self-contained unit consisting of cabinet, supply fan, controls, filters,

B. Cabinet:
1. 1" double walled, 18 gauge galvanized or aluminized steel panels formed to ensure rigidity and supported by galvanized-steel channels or structural channel supports with lifting lugs. Cabinet shall be fully weatherized for outside installation.
2. Cabinet fabricated of 18 gauge aluminized steel.
3. Rigid welded frame. (Units that utilize zip screws in the manufacture of the units are not acceptable).

4. Access Panels: Weather-resistant, easy access hinged access doors with Ventlok handles and lock open braces for complete access to furnace, fan motor assemblies, and filter section.
5. Internal Insulation: 1-inch with 20 gauge aluminized liner.
6. Finish: PPG PSX 700 Industrial siloxane epoxy paint on exterior with 5500 hour salt spray requirement. Color to be light gray.

C. Supply Air Fan:
1. Fan Type: Centrifugal, double-width, double- inlet forward-curved fan rated according to AMCA 210; statically and dynamically balanced, galvanized steel; mounted on solid-steel shaft with heavy-duty, self-aligning, grease-lubricated pillow block ball bearings.
2. Fan Bearings: Rated to a minimum of 100,000 hours (L-10 Life).
3. Motor: TEFC single-speed motor.
4. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly.
5. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with spring vibration isolators.

D. Outside Air Intake:
1. N/A

E. Air Filters:
1. Comply with NFPA 90A.
2. First outside air filter section to have pleated filters: 2-inch- thick, pleated type with a minimum efficiency value of MERV 8 according to ASHRAE 52.2.
3. 1" x 3" 16 gauge wire metal screen shall be provided downstream of the filters to ensure that the filters will not enter the coil and fan section in the case of a collapsed filter.
4. Provide two (2) complete sets of filters.

F. Dampers:
1. Outside Air: low leak, 16 gauge galvanized parallel blade damper with vinyl blade edge seals, and spring stainless steel side seals.
2. Damper Operator: Direct coupled, as required by the control sequence.

G. Burners:
1. Cast aluminum burner – direct gas fired, low emissions style with stainless steel baffles.
2. Gas pressure requirement at the unit inlet is 9.5” w.c. minimum with 14” w.c. maximum.
3. Fuel: Natural Gas

H. Controls:
1. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote thermostat.
2. Control Panel: Surface-mounted panel, with engraved plastic cover, and the following lights and switches:
   a. Summer-Off-Winter switch.
   b. Supply-fan operation indicating light.
   c. Heating operation indicating light.
   d. Dirty-filter indicating light operated by unit-mounted differential pressure switch for both sets of filters
   e. Safety-lockout indicating light.
3. Remote Thermostat: Provide explosion proof and corrosion resistant room temperature sensor to enable space temperature supply air temperature reset.
4. Refer to Section 23 09 93 - Sequence of Operations - HVAC for control sequences of operation.

I. Control Devices:

1. Outside-Air Damper Control: Outside-air damper shall open when supply fan starts, and close when fan stops.
2. Packaged Unit Controls: Stand-alone control module for packaged unit controls. Coordinated controls and control sequence Section 23 09 93 - Sequence of Operations - HVAC for control sequences of operation.
3. Mild Weather Thermostat: adjustable thermostat that will automatically turn off the burner when the outdoor temperature rises above the stat et-point. The burner reignites if the temperature falls below set-point. The mild weather sensor shall be located in the outside air stream of the unit.

J. Accessories:
1. Heavy duty forward curved blower with extended grease fittings.
2. Low fire start.
3. Purge Timer.
4. Hinged Doors.
5. Non-fused disconnect.
6. High Temperature Limit Switch.
7. 40 inch high upright inlet plenum base.
8. Remote explosion proof and corrosion resistant thermostat.
9. Control panel contacts:
   a. Interlocking relay for remote exhaust fan.
   b. Auto status contact for SCADA notification.
   c. Run status contact for SCADA notification.
   d. General alarm contact for SCADA notification.

1.07 EXECUTION

A. INSTALLATION:

1. Install equipment in strict accordance with manufacturer's instructions.

2. Units which are shipped in multiple sections shall be assembled on the job site. Assembly includes caulking all seams weather tight and extending electrical power and control wires to the terminals provided, reconnecting the motor and control wiring between sections to create a complete and operable installation (per makeup air unit manufacturer's recommendations).

B. INSTALLATION ASSISTANCE AND START-UP SERVICES:

1. Inspect MAU installation prior to start-up. Complete and submit an installation verification checklist to the Engineer and Owner prior to unit start-up.

2. Furnish a factory trained service engineer to start the unit, perform performance and safety check test, summer / winter operation, alarm conditions, etc.

C. OWNER TRAINING:

1. Work with the Installing Contractor to provide Owner Training in the proper operation and maintenance of the new MAU equipment.

2. Review O&M documentation with Owner.

3. Allow a total of four (4) hours for Owner Training.

END OF SECTION

SECTION 23 82 00
UNIT HEATERS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

A. Work required under this section includes providing natural gas unit heaters.

1.02 SUBMITTALS:

A. Submit required shop drawings per Division 1.

B. Product Data for the following:
1. Unit Heaters

1.03 PRODUCT DELIVERY, HANDLING AND STORAGE:

A. Protect all equipment with factory finish from damage from moisture, denting, scratches, etc.

1.04 RELATED SECTIONS:

A. Section 23 00 00 – HVAC General Provisions

B. Section 23 10 00 – Basic HVAC Materials and Methods

C. Section 23 05 90 – Testing, Adjusting, and Balancing

D. Section 23 09 93 – Sequences of Operation

PART 2 - PRODUCTS

2.01 UNIT HEATERS:

A. As scheduled on drawings.

B. Provide all required accessories as schedules on the drawings and otherwise as required for a complete working system.

C. Acceptable manufacturers: Reznor, Trane, Modine, or approved equal.

PART 3 – EXECUTION

3.01 Installation:

A. Install in accordance with manufacturers' recommendations.

B. Provide all necessary incidental equipment, wiring, and material for complete installation. Allow adequate clearance around equipment, piping, and fittings for maintenance and operation.

C. Submit equipment startup report.

END OF SECTION

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ELECTRICAL SPECIFICATIONS
DIVISIONS 26 & 27
TABLE OF CONTENTS

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SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. General provisions for electrical work for the wastewater system improvements to the Biopure Treatment Facility located in Hart, Michigan.

B. The major improvements covered by these specifications include the following:
1. New Headworks Screening and Grit Removal System
2. Aeration and Basin improvements to the East Biosolids Basin
3. New West Biosolids Basin & Aeration
4. New Biosolids Pump Station
5. Replacement of the Polishing Pond Pump Station
6. New South Clarifier Building
7. Modifications to existing Inlet Splitter Box
8. Modifications to existing Main Control Panel (MCP)

C. Coordinate construction activities, demolition, relocation and installation of electrical related systems with other trades.

1.02 SUMMARY OF WORK:

A. General:
1. Prior to performing the work, the Contractor shall familiarize himself with the site, and be aware of limitations to consider when accessing the work location with construction equipment. Coordinate all work on site with the Engineer, particularly related to sequence, placement, storage, lifting, etc., of all construction equipment and materials.
2. Obtain permits required by the county and other local jurisdictions for work performed by this contract.
3. Coordinate demolition, layout and installation of all work for this contract with other Contractors on site and through the Engineer.
4. Furnish and install all support devices including miscellaneous steel, hangers, brackets, clamps, anchors, etc., as required to adequately install, support, and maintain all conduit, cable tray, cables, lighting, distribution equipment, instruments, devices, and fixtures installed by this contract.
5. Layout, coordinate, furnish and install all sleeves, flashing, and patching as required for all wall, roof, floor, grating, etc., penetrations for all work by this contract. Utilize a roofing contractor for cutting and patching at all roof penetrations for piping and supports.
6. Field touch-up paint to existing condition, all equipment damaged or installed by work performed by this contract in accordance with Owner's painting standards and the technical specifications.
7. Coordinate deliveries, receipt, handling, offloading, storage and security for all Contractor furnished materials. Owner or Engineer will not be responsible for lost or stolen materials furnished by Contractor and will not assume responsibility for materials until satisfactory installation. Coordinate on site storage of all Contractor furnished materials and equipment with the Engineer.
8. Receive, inspect, offload, store, stage, and protect all equipment, devices, and materials furnished by the Owner for this contract.
9. Furnish and install all equipment grounding.
10. "Commission" or energize all equipment and systems installed by this contract including coordination with Engineer and other contractors.
11. Provide start-up assistance for systems furnished under this contract.
12. Maintain on site a detailed as-built record set of all work installed by this contract as applicable. Final set to be submitted to Engineer upon completion of work.

B. Electrical Scope Description:
   1. Refer to the drawings and specifications for the extent of demolition, upgrade and replacement work at the Biopure Treatment Facility.

1.03 STANDARDS:

A. Applicable Standards and Codes:
   1. Institute of Electrical and Electronic Engineers (IEEE).
   2. Underwriters Laboratories, Inc. (UL).
   3. National Electrical Manufacturers Association (NEMA).
   4. National Electrical Code (NEC).
   5. American Society for Testing and Materials (ASTM).
   6. American National Standards Institute (ANSI).
   7. National Board of Fire Underwriters (NBFU).
   8. National Fire Protection Association (NFPA).
   9. National Electrical Contractors "Standard of Installation" (NECA)
   10. Joint Industrial Council (JIC).
   11. Code of Federal Regulations (CFR). Title 29 Labor, Subpart S-Electrical.

B. Where quantities, sizes, or other requirements shown on the drawings or specified herein exceed the requirements of the above standards and codes, the drawings and specifications shall govern.

1.04 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Submit materials and equipment for review to Engineer as required in each section. Each sheet of descriptive literature submitted shall be clearly marked to identify the material or equipment, and shall show the specification paragraph for which the equipment applies.
   1. Submit schematics and connection diagrams for all electrical equipment. A manufacturer's standard connection diagram or schematic showing more than one scheme of connection will not be accepted unless it is clearly marked to show the intended connections.
   2. Submittals showing more than the particular item under consideration shall have the pertinent description paragraph for which the equipment applies circled, or highlighted with a marker intended for that purpose.

C. Prepare and maintain Record Drawings current with work completed. Show all changes to underground and other hidden work. Submit to Engineer on completion of project.

D. After award of the contract and prior to starting any work, the Contractor shall submit to the Engineer:
   1. List of Subcontractors scheduled and planned for utilization on the project.
   2. Detailed work plan outlining methods and procedures to accomplish the intent and purpose of the contract.
   3. Work schedule detailing dates of principle events and completion date. All downtime needed in the schedule shall be approved by the Owner.

E. Operating and Maintenance Instructions:
   1. Upon completion of all work and tests, instruct the Owner in the operation and maintenance of all components.
   2. Furnish sets of written Operation and Maintenance Manuals per Section I.3.D. - Submittals.

1.05 CLEARANCES:

A. Equipment:
1. Maintain clearances from electric panels, and other electrical installations as required by NEC and CFR.
2. Maintain working clearances around electrical equipment as required for proper maintenance and operation.

1.06 IDENTIFICATIONS:

A. Provide identification signs on all electrical equipment, control panels, switches, breakers, and panels.

B. Provide a type written circuit identification schedule in each distribution or branch circuit panelboard under glass or plastic. Each circuit to be identified by load.

1.07 CODES AND STANDARDS:

A. These specifications are minimum requirements and shall govern except where made more stringent by other sections of this specification or local, state, or federal laws or regulations. In the event of conflict between these specifications and applicable codes and regulations, the codes and regulations shall govern.

1.08 PERMITS AND INSPECTIONS:

A. Obtain all necessary permits and pay all fees in connection with all permits, inspections, and approval by the proper authorities in local jurisdiction of such work. Final inspection by the Owner will not occur until necessary certificates of satisfactory inspection are received.

1.09 ELECTRICAL UTILITY ALLOWANCE:

A. Electrical Contractor to include a $10,000.00 allowance within his base bid to pay for a new 120/240-volt, 1-phase electrical service located at the Wastewater System Rapid Infiltration Beds to power a Sampling & Metering Enclosure. The Rapid Infiltration Beds are located on the south side of W. Polk Rd. approximately 3,200 feet east of the Biopure Treatment Facility on parcel 007-022-200-01. Temporary construction power, in and out charges and temporary power KWHr consumed during construction are not part of this allowance. Only the paid invoices from the electrical utility company for permanent service are to be deducted from the allowance. A Change Order will be written adjusting the base contract +/- upon submission (marked paid) of the utility invoices. Coordinate with Matt Ashbaugh, Great Lakes Energy, 888-485-2537 x8522.

B. Electrical Contractor to include a $10,000.00 allowance within his base bid to pay for relocation of the existing overhead primary service conductors routed along the south side of the Biopure Treatment Facility site and relocation of the existing underground primary service conductors out of the footprint of the proposed South Clarifier Building on the east side of the Biopure Treatment Facility site. Only the paid invoices from the electrical utility company for relocation of existing services are to be deducted from the allowance. A Change Order will be written adjusting the base contract +/- upon submission (marked paid) of the utility invoices. Coordinate with Mike Schiller, Hart Hydro Department, 231-873-5367.

1.10 DRAWINGS:

A. Drawings and specifications are provided for assistance to the Contractor and are diagrammatic only to indicate the general arrangement and location of circuits, outlets, etc.

Exact locations will be determined by field conditions. Deviations from the arrangement indicated to meet actual conditions shall be made with no expense to the Owner. Throughout the progress of construction, the Contractor shall keep a set of detailed field record drawings, including the exact location of concealed work and underground utilities. This requirement does not authorize any deviations from the contract drawings without prior approval from the Owner. The field record information shall be marked in a legible manner on prints of the drawings. At the completion of work, the Contractor shall deliver the field record information to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. All electrical equipment and material shall be furnished new and shall be accepted, or certified, or listed or labeled or otherwise determined to be safe by a nationally recognized testing laboratory (NRTL).
   1. Equipment shall be accepted, certified listed labeled by Underwriters Laboratory, Inc. (UL) Factory Mutual, Inc. (FM).
   2. Equipment or material accepted certified, listed or labeled by an accepted NRTL shall be used in preference to equipment or material that does not have that acceptance.
   3. If equipment or material has been inspected or tested by a Federal Agency or by the State of Michigan or by the municipality having jurisdictional responsibility for enforcing occupational safety provisions of the National Electrical Code (NEC) and found in compliance with the provisions of the NEC as applied in paragraph 1910.309 of Department of Labor General Industry Safety Standards Commission Bulletin.
   4. Custom manufactured or installed equipment shall use components accepted, certified, listed or labeled by a NRTL and manufactured shall submit data indicating such acceptance, certification listing or labeling to the Engineer.

B. Substitutions for materials and equipment listed herein must be of equal standards, quality and desired operation, or superior. There will be no approval or consideration for approval of equipment or material submittals for substitution prior to award of the contract.

C. All packaged equipment shall be completely factory wired prior to delivery to the jobsite. Connection to and bonding of this equipment is required under this section of the specifications.
   1. Check all prewired controls before energizing to verify that all internal wiring is properly coordinated to the voltage to be applied.

2.02 SHOP/FACTORY/FINISHING:

A. Provide baked enamel finishes on exposed surfaces.

B. Provide galvanized finishes for damp or wet locations.

C. Touch up or refinish damaged paint.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Provide and install all equipment as specified, required or implied in this specification except as noted. This requirement shall include all labor, materials, and incidentals in a manner consistent with good practice necessary to a complete operable installation.

B. The Contractor shall implement cooperation with other trades by his reference to the Structural and Mechanical drawings and specifications for work by other trades and to be carried on simultaneously or sequentially with the electrical work. This requirement is to facilitate construction to proceed with no harm to the Owner due to the absence of cooperation. All other drawings and specifications shall become part of the Electrical specifications as they relate to electrical work.

C. Verify equipment dimensions to insure dimensional compatibility.

D. All excavation, backfilling, and concrete work shall conform to the applicable sections of these specifications.

E. The Contractor is responsible for connecting wiring and circuitry to all equipment furnished by others and the Contractor that requires electrical power or control.

F. The Contractor shall demonstrate to the satisfaction of the Owner at final inspection that the wiring is complete and free from open circuits, short circuits between circuits or ground and that systems operate satisfactorily. The entire electrical installation shall be demonstrated to operate in accordance with the specifications. This test shall be made with no devices connected to prevent damage to equipment, and resistance shall be greater than one megaohm.

3.02 TEST AND OPERATION:

A. Equipment:
1. Thoroughly clean, lubricate, and protect from damage and dirt during operation.
2. Test and operate in accordance with manufacturer's recommendations.

END OF SECTION

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SECTION 26 05 19
ELECTRICAL CONDUCTORS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work of this section includes wire and cable for all types of applications 600V and below.

1.02 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Provide voltage and insulation test data from the cable manufacturer.

1.03 DELIVERY, STORAGE, AND HANDLING:

A. Cable shall be on original reels or in boxes and shall be new and unused.

B. Store cables in dry protected area and protect cable ends in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 LOW VOLTAGE, LIGHTING AND POWER CONDUCTORS:

A. Conductors provided on 120/240 volt, 120/208 volt and 277/480 volt power and lighting systems to be stranded per ASTM B-8 soft drawn copper.

B. Insulation system shall be type THHN or THWN-2 rated 600V as defined and listed in Article 310 of NEC.

C. Minimum size conductor utilized shall be #14 AWG for control circuits and #12 AWG for power and lighting circuits.

D. Color code conductor insulation as follows:
1. Line Voltage - Black
2. Grounding Conductor - Green
3. Neutral - White
4. Control - Red
5. Color shall be integral with the insulation compound applied by cable manufacturer.

2.02 VFD LOAD CONDUCTORS:

A. 480V conductors provided between VFDs and motors and terminals to be stranded per ASTM B-8 soft drawn copper.

B. Insulation system shall be type XHHW-2, 90°C rated 600V as defined and listed in Article 310 of NEC.

C. Single copper conductor, stranded, insulated with moisture, heat, and flame resistant, chemically cross-linked polyethylene insulation.

D. Minimum size conductor utilized shall be #12 AWG.

E. Color code conductor insulation as follows:
1. Line Voltage - Black
2. Grounding Conductor - Green

3. Color shall be integral with the insulation compound applied by cable manufacturer.

2.03 INSTRUMENTATION CABLES:

A. Instrumentation conductors shall be stranded copper conductors minimum size #18 AWG.

B. Instrumentation conductors shall be paired, and each pair twisted and 100% shielded.

C. Instrumentation cables to have minimum 300-volt insulation on each conductor and have a jacket overall.

D. Acceptable Manufacturers: Houston Wire and Cable, Belden, or approved.

PART 3 - EXECUTION

3.01 LOW VOLTAGE LIGHTING AND POWER CABLES:

A. Install only after completion of work, which might cause damage to wires or conduit.

B. Clean out or replace conduit in which dirt, water, concrete, or other foreign matter has been allowed to accumulate, before installing wiring.

C. Use THHN or tray rated cable and wire for routing in cable tray.

D. Identify each end of each conductor by wire marking tape or sleeve. Mark on outer cover giving voltage, type, sizes, and circuit number.

E. Splices:
1. No wire splices allowed in entire length of conduit or raceway.
2. Make splices in electrical enclosures.
3. Splice Insulation: Equal to original factory insulation.
4. Splicing Copper to Aluminum: Use aluminum-copper connections; approved as suitable for the purpose.

F. Termination of Conductors:
1. Insulated type compression lugs.
2. At distribution equipment containing aluminum bus bars, use aluminum copper lugs rated and approved for the application.

G. Provide separate conduit for each type of circuit (power, controls, and communications).

H. Conductors terminating at outlets shall be left not less than 8 inches long within outlet box.

3.02 INSTRUMENTATION CABLE:

A. Install only after completion of work, which might cause damage to wires or conduit.

B. Clean out or replace conduit in which dirt, water, concrete, or other foreign matter has been allowed to accumulate, before installing wiring.

C. Splices: No wire splices allowed in entire length of conduit or raceway.

D. Provide separate conduit for instrumentation circuits.

E. Mark on outer cover the control loop number at each end and each conductor the wire number by wire marking tape or sleeve.

F. RF cable shall be installed in metal conduit.

3.03 FIREPROOFING OF CABLES:

A. Fireproofing of wires and cables shall be accomplished by half lapped taping using electrical arc and fireproofing tape made of heat resistant organic coated on one side with a flame-retardant elastomer. The fireproofing tape shall be held in place by spiral wrapping at 18-inch intervals using pressure sensitive glass cloth tape 2 inches in width.

3.04 GROUPING OF CABLES:

A. Lace or plastic band groups of feeder conductors at distribution centers, pull boxes and wire ways.

3.05 WIRE PULLING:

A. Use wire pulling lubricant for pulling (No. 4 AWG) and larger wire. Do not pull cables through conduit with more than allowable bends specified in NEC 345-11. Only approved pulling compound that is suitable for the type wire insulation is allowed.

END OF SECTION

[Intentionally left blank]

SECTION 26 05 26
GROUNDING

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work of this section includes equipment for an effective grounding system.

1.02 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Certified ground resistance tests on each ground rod and the complete service system consisting of multiple rods and grounding conductor.

C. Ground resistance tests on total systems.

1.03 STANDARDS:

A. IEEE Standard 142.

B. NEC Article 250.

PART 2 - PRODUCTS

2.01 GROUNDING ELECTRODE:

A. Grounding electrode to be ground rods.

B. Ground rods shall be bonded copper type steel core with thick copper covering inseparably bonded together 3/4" diameter x 10 ft length. Ground rod couplings are to be used if rod length of greater than 10 feet is required.

2.02 GROUNDING CONNECTIONS:

A. To be thermoweld when concealed or where required by Owner.

B. To be mechanical where exposed to view.

C. Where the grounding conductor penetrates a concrete surface use a 5/8 inch solid copperweld rod or a thermoweld antisyphon water stop.

2.03 GROUNDING ELECTRODE CONDUCTOR:

A. Grounding electrode conductor is to be as shown and sized in accordance with Table 250-66 of NEC.

2.04 EQUIPMENT GROUNDING CONDUCTORS:

A. Equipment grounding conductors shall be copper sized in accordance with Table 250-122 of NEC.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Ground resistance tests of each ground rod shall be made and results signed as correct by the Contractor.

B. Provide grounding with ground rods of length required to achieve specified ground resistance of 25 ohms or less (per ground rod). Use three rods driven in triangle

formation and connected in parallel. Provide ground rods at location shown (multiple rods may be required to achieve specified resistance).

C. Bond the non-current carrying parts of all electrical equipment installed under this contract including metallic raceways, raceway supports, motors, equipment enclosures, and metallic cable sheaths by means of bare copper cable or copper strap to the station grounding system or as shown.

D. All power, lighting over 120 volts and receptacle circuit conduits shall include a ground conductor sized per the NEC. Attach grounding conductors to equipment by means of approved copper alloy solderless grounding lugs or clamps which shall be secured to the equipment and the grounding point by means of hexhead cap screws or machine bolts after the contact surfaces have been cleaned to bright metal.

E. Ground conductors run in conduit with circuit conductors are to be securely connected inside the junction boxes or enclosures. Splices in ground conductors shall be made by the "Cadweld" process by Erico Products, Inc., Continental Industries "Thermoweld", or equal.

F. Support ground straps at intervals not exceeding two (2) feet by means of round head bronze machine screws and approved type anchors.

G. Electrical grounding system in well houses are to be grounded to the metallic well casing.

H. All circuits in non-metallic raceways shall include a ground conductor sized per the NEC or as shown. Attach grounding conductors to equipment by means of hexhead cap screws or machine bolts after the contact surfaces have been cleaned to bright metal. Ground conductors terminating at the motor control centers, switch gear, to be terminated at the ground bus.

END OF SECTION

SECTION 26 05 33
CONDUIT

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work of this section includes electrical conduit systems.

1.02 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

1.03 RELATED WORK:

A. Section 26 05 34 - Electrical Boxes.

PART 2 - PRODUCTS

2.01 CONDUIT:

A. Rigid Galvanized Steel Conduit (RGS):
1. Unless otherwise detailed or specified elsewhere in the Specifications or Drawings, conduit for all locations shall be Rigid Metal Conduit (RGS).
2. Rigid galvanized steel metal conduit (RGS) shall be threaded, hot dipped galvanized inside and out conforming to U.L. Standard 6 and ANSI C80.1.
3. Acceptable manufacturers: Allied Tube and Conduit, Columbia, Omega, or Wheatland.

B. Intermediate Metal Conduit (IMC):
1. Intermediate metal conduit (IMC) shall be galvanized, threaded, conforming to UL 1242 and ANSI C80.6.
2. Intermediate metal conduit may be used in lieu of rigid steel conduit.
3. Acceptable manufacturers: Allied Tube and Conduit, Republic and Wheatland Tube.

C. PVC coated RMC:
1. PVC coated conduit shall be galvanized steel with 40 mils thickness of polyvinyl chloride bonded at the factory to the outside of conduit conforming to NEMA RN-1 (Type 40). Inside of conduit to be coated with urethane coating. Threads to be coated with urethane.
2. Acceptable manufacturers: Robroy Industries, Perma-Cote, Plasti-Bond, Kor Kap and Thomas & Betts.

D. Rigid Nonmetallic Conduit:
1. Rigid nonmetallic conduit shall be PVC schedule 40 or schedule 80 heavy wall, rated for 90°C conductors and for use in direct sunlight conforming to UL 651 and Federal Specification W-C-1094A.
2. Use only couplings and fittings designed specifically for the type of conduit noted. Follow the manufacturer's recommendations regarding the handling, bending, coupling and installation.
3. Acceptable manufacturers: Carlon, Certainteed, or Cantex.

E. Liquidtight Flexible Metal Conduit:
1. Liquid-tight Flexible Metal Conduit shall have flexible interlocking steel, spiral strip, galvanized with oilproof and waterproof flexible PVC jacket, conforming to UL standards.
2. For hazardous areas, provide explosion proof flexible conduit with insulated wireduct, threaded end fittings, bronze braid covering with flexible brass inner core, (overall neoprene protecting coating), in accordance with U.L. 886.
3. Acceptable manufacturers: Anaconda, Flex-Guard, Inc., Liquatite, or O-Z/Gedney Company.

2.02 COUPLINGS AND CONNECTORS:

A. For rigid galvanized steel conduits, provide RGS couplings galvanized, threaded, and of the same manufacturer.

B. For electrical metallic tubing, couplings and connectors to be steel compression gland type, and of the same manufacturer.

C. For rigid non-metallic PVC conduit, couplings and terminal adapters to be PVC, liquid tight, suitable for the conduit with which the couplings and adapters are used and of the same manufacturer.

D. Flexible conduit connectors shall be compression gland, liquid tight type.

E. Connectors to metallic boxes or conversion to metallic conduit: Provide adapters as recommended by conduit manufacturer to provide a watertight threaded connection.

2.03 FITTINGS:

A. UL listed.

B. Provide grounding type watertight/dusttight conduit hubs, by Myers or equal, for all conduit entries into outdoor control panels and junction boxes.

C. For metallic conduit, liquid tight, malleable iron alloy body and cover, zinc coated and stainless steel screws.

D. For nonmetallic conduit, liquid tight, utilizing the same non-metallic material as used in the conduit for body and the cover. Cover screws shall be stainless steel.

2.04 CLAMPS & HANGERS:

A. Hot dipped galvanized malleable iron straps with back spacers, and hot dipped galvanized strap hangers with zinc plated threaded rods and hardware.

B. PVC or other nonmetallic straps as recommended by the conduit manufacturer for the nonmetallic conduit. Any metallic screws, bolts, nuts or other attachment hardware to be stainless steel.

C. Trapeze type hangers shall be:
1. For galvanized conduit, use galvanized steel channel support system with (zinc plated) threaded rod and hardware, as manufactured by Super-Strut or Unistrut.
2. For nonmetallic conduit, use fiberglass strut support system or PVC coated strut support system with plastic coated or stainless-steel hardware.

2.05 CONDUIT SEALING FITTINGS:

A. Sealing compounds used for conduit sealing fittings shall be permanent and shall be recommended by conduit fitting manufacturer as suitable for sealing fitting in (classified) locations.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install the conduit in accordance with the manufacturer's recommendations. All buried conduits outside of buildings shall have locations marked on drawings. Minimum conduit size shall be 3/4". In no event shall the conduit size be less than required by National

Electric Code for the wire size and number indicated. Galvanized conduit shall not be painted except where shown.

B. Utilization Areas:
   1. Use Rigid Metal Conduit in all exposed outdoor areas unless noted otherwise, below-grade valve chambers, and to 24" below grade.
   2. Use PVC coated metal conduit in the following areas:
      a. Headworks Building Screen & Grit Room.
      b. Aeration Basins (abovegrade)
      c. Biosolid Basins (abovegrade)
   3. Use PVC Schedule 40 conduit in wet wells, under-ground and under-slab construction, and concealed in CMU walls of the Headworks Building.
   4. Use Liquidtight Flexible Metal Conduit or Explosion Proof Flexible Metal Conduit for:
      a. Motor terminations, where applicable.
      b. Termination to instrumentation and field control devices, where applicable.

C. General Installation Guidelines:
   1. Metal conduit systems shall be bonded to grounding systems.
   2. Run conduit parallel to or at right angles to building lines, except when in concrete slab or run under base slab. Support conduit at a maximum of 8 feet on center.
   3. Installation of conduit in concrete slabs and walls shall maintain two times (2x) the conduit diameter spacing between conduits. Maintain a distance of 3" from floor openings and wall penetrations. Maintain a minimum of 3" below all finished concrete surfaces.
   4. Bends for low voltage wiring shall be standard ells with a maximum equivalent of (4) four quarter bends in any run between pulling joints. Bends for medium voltage wiring shall be wide radius ells with a maximum equivalent of (3) three quarter bends in any run between pulling joints.
   5. Paint the ends of RGS joint couplings or threaded fittings with zinc rich coating of at least 90% purity zinc. Use cold galvanizing compounding ZRC Products Co. or Zinc-It or equal.
   6. Fasten all conduits entering boxes with locknut and bushing in the inside and locknut on the outside.
   7. Furnish and install Liquidtight Flexible Metal Conduit connections to all motors, solenoids and vibrating equipment. Conduit shall be a minimum 18 inches in length and shall be sufficiently long to enable motor to be moved to allow the disconnecting of the motor coupling without disconnecting the motor and shall be equipped with approved type grounding devices to ensure continuity between the conduit and the connection. In all cases, Liquidtight Flexible Metal Conduit runs shall not exceed 6 feet in total length.
   8. Clean all conduit thoroughly inside and outside after installation and just before pulling cables. All conduits not terminated in metal fittings or metal cabinets and secured with locknuts shall be terminated with grounding bushings.
   9. Install only undamaged conduit. Plug ends to prevent entry of dirt and moisture.
   10. Layout conduit routing to avoid structural obstructions and minimizing crossovers. Conduit runs must be installed in a neat and well-planned arrangement and in a manner that will not interfere with access to equipment or with the use of access ways.
   11. Provide conduit sealing fittings and seal conduit with duct seal where conduits leave heated area and enter unheated area.
   12. Provide flashing and pitchpockets in making watertight joints where conduits pass through roof or waterproofing membranes.
   13. Install UL approved expansion fittings complete with grounding jumpers where conduits, metallic or non-metallic cross building expansion joints. Provide bends or offsets in conduit adjacent to building expansion joints where conduit is installed above suspended ceilings. In exposed PVC conduit runs longer than 50

feet, provide expansion couplings near boxes or devices. In exposed PVC conduit runs which do not have devices or boxes, an expansion coupling shall be installed for every 100 lineal feet of conduit.

14. Whenever PVC is used, install a separate ground wire, and use rigid ells where exterior or poured concrete surfaces are penetrated. Also, provide rigid elbows where necessary to prevent "burn-through" of PVC conduit when pulling wire.
15. Make transitions between nonmetallic conduits and conduits of other materials with the manufacturer's standard adapters designed for such purposes.
16. Conduit shall be securely attached to the building structure. Unless otherwise indicated, all electrical equipment shall be spaced at least 1/2 inch from the wall with hanger clamps to Unistrut, Super Strut, or equal.
17. For single metallic conduit runs use galvanized conduit straps or ring bolt type hangers with specialty spring clips. Perforated strap is not allowed. Groups of conduits shall be supported on trapeze type hangers, Unistrut, or equal. Individual conduits not supported on conduit straps shall be provided with clevis type hangers. Hanger support shall be rod with threaded connections.

D. Anchor Methods:
1. Hollow Masonry: Toggle bolts or spider type expansion anchors.
2. Solid Masonry: Lead expansion anchors or preset inserts.
3. Metal Surfaces: Machine screws, bolts, or welded studs.
4. Wood Surfaces: Wood screws.
5. Concrete Surfaces: Self-drilling anchors or power-driven studs.

E. Conduit runs as indicated on drawings are schematic, exact routing of conduit to be approved by the Engineer. Make field bends and offsets uniform and symmetrical, without flattening conduit or scarring conduit finish and of minimum radius for each size as given in NEC Article 346.

F. Conduit shall be as shown on plans and/or as required for the installation of outlets and devices shown on drawings. All conduits shall be supported from the structure or provided rods independent of all other trades. Proper location of conduits shall be the responsibility of the Electrical Contractor who shall avoid interferences with other trades.

G. Install a pullwire in all empty conduits. All empty conduits installed for future use shall be capped or plugged and properly identified.

H. Hazardous Areas/Locations Installation:
1. In these areas, conduit and fittings shall be gas-tight using conduit sealing fittings where conduit enters or leaves such areas.
2. For conduit installations 2" inches diameter or larger and housing manufacturer pump cables shall have retrofit style conduit seals.
3. Conduit installation in hazardous locations shall be suitable for Class I, Division 1, Group D areas in accordance with NEC Article 501. Sealing compounds used for conduit sealing fittings shall be UL approved and shall be recommended by conduit fitting manufacturer as suitable for sealing fitting in hazardous locations.
4. Conduit seal fittings; After Dams are Made and Before Pouring Compound:
    a. Any horizontal seal must be suitable for horizontal use.
    b. No splices or taps in the sealing fitting.
    c. The sealing fitting shall be approved for the hazardous vapor involved, i.e., Class I, Group D.
    d. The dam or dams shall be of material specified by the fitting manufacturer.
    e. The individual wires are separated in the area to be filled with compound.
    f. Any tube for drains is properly installed.
    g. Finally, the Inspector shall approve the fitting as ready for compound by spraying a distinctive color of paint on the fitting.
5. During Pouring of Compound:
    a. The compound shall be prepared as specified by the manufacturer.

b. All sealing compound to be poured before the initial compound has hardened.
c. If excessive amounts of compound are required to fill the fitting, it shall be disapproved. The dam shall be corrected.
d. The Inspector shall approve the pouring by spraying a second distinctive color of paint on the fitting.

6. Final Inspection:
   a. The sealing compound shall be hard and dry.
   b. The compound should fill the fitting to the level specified by the manufacturer.
   c. At least five (5) full threads of the inspection opening shall be free of sealing compound.
   d. Any drain tube must not extend above the surface of the compound. There shall be an adequate opening to the drain fitting.
   e. All covers and plugs shall be installed with five (5) full threads engaged.
   f. The Inspector shall indicate final approval by spraying a third distinctive color of paint on the fittings.

I. Drains are required where it is probable that liquid or any condensed vapor may be trapped within enclosures, accumulated on seals, or accumulated at any point in the raceway system. All drains shall provide continuous draining. Drains shall be provided as follows:
   1. At the low points of any conduit system where any portion between seals is outdoors or in a building without heating facilities. Note especially any vertical sealing fittings.
   2. At any control or wiring enclosure that is outdoors or in a building without heating facilities.
   3. At any Class I enclosure with internal volume of more than 400 cubic inches. The drain may be provided by the conduit system.
   4. At canned pumps, process instrument, etc., which have only a single seal to prevent process fluids from entering the wiring system. This drain must be "adequate" and should make any leak "obvious" per NEC Article 501-5(d) (3).

END OF SECTION

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SECTION 26 05 34
ELECTRICAL BOXES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work of this section includes junction boxes, pull boxes, and outlet boxes for interior, exterior, and hazardous locations.

1.02 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

1.03 RELATED SECTIONS:

A. Section 26 05 33 - Conduit.

PART 2 - PRODUCTS

2.01 CONDUIT BODIES, JUNCTION, PULL, AND OUTLET BOXES:

A. All conduit bodies used with rigid steel galvanized conduits shall have malleable iron bodies with stamped steel covers and stainless steel screws. The finish shall be zinc electroplate and aluminum polymer enamel.

B. All hazardous location conduit bodies used with PVC coated rigid steel galvanized conduits shall have PVC coated malleable iron bodies with threaded cover openings, threaded O-ring sealed covers. The finish shall be zinc electroplate and aluminum polymer enamel.

C. All boxes used outdoors, around open treatment basins, and in wet locations shall NEMA 4X, stainless steel, hinged cover JIC Type unless noted otherwise on the drawings.

D. All boxes used indoors with rigid steel galvanized conduits for surface installation shall be NEMA 12, steel, hinged cover, JIC Type unless noted otherwise on the drawings.

E. All boxes and conduit bodies used with non-metallic conduits shall be (PVC) with stainless steel cover screws unless noted otherwise on the drawings.

F. All boxes and conduit bodies shall be UL listed and conforming to area classification. All boxes, bodies and fittings shall be NEMA 1, NEMA 3R, NEMA 4X, NEMA 7/9 to meet area classification as noted on the drawings.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Clean interior of boxes of moisture, dirt, metal filings or other foreign matter.

B. Assure that all conduit fittings that enter the box are tight and secure.

C. Locate boxes in walls and on other surfaces as shown on the drawings.

D. In hazardous areas use only explosion proof boxes.

END OF SECTION

[Intentionally left blank]

SECTION 26 05 44
ELECTRICAL HANDHOLES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The work of this section includes furnishing and installing reinforced fiberglass handholes.

1.02 RELATED WORK:

A. Section 26 05 33 - Conduits.
B. Section 26 05 34 - Electrical Boxes

1.03 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

1.04 REFERENCES:

A. Fiberglass handholes
   1. ASTM D543, Test Method for Resistance of Plastic to Chemical Reagents.
   2. ASTM D570, Test Method for Water Absorption of Plastic.
   3. ASTM D635, Test Method for Rate of Burning and/or Extent of Burning of Self-Supporting Plastics in a Horizontal Position.
   4. ASTM D756, Practice for Determination of Weight and Shape Changes of Plastic Under Accelerated Service Conditions.
   5. ASTM D790, Test Method for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials.
   6. ANSI 77 2002, Specification for Underground Enclosure Integrity.
      a. Handholes and covers shall be Tier 15 rated unless noted otherwise on drawings.

PART 2 - PRODUCTS

2.01 REINFORCED FIBERGLASS HANDHOLES:

1. The handhole boxes shall be constructed of plastic mortar reinforced by heavy weave fiberglass and shall meet or exceed the requirements of ASTM D543, ASTM D570, ASTM D635, ASTM D756, and ASTM D790.

2. The cover shall be designed to be subjected to light vehicular traffic and be able to withstand a minimum of 5000 pounds single axle load over any 10 inch by 10 inch area. Cover shall have standard logos "ELECTRIC" or “FIBER OPTIC”.

3. The boxes and covers shall, service box assemblies with penta-head fastener nuts.

4. Minimum handhole size: 18"l x 12"w x 18"d. Size shall be based on actual cable bend radius requirements and fill requirements per NEC.

5. Acceptable Manufacturer: Hubbell (Strongwell) - Quazite open bottom "PG" Style or equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. All manholes/handholes shall be delivered to the jobsite and unloaded in good condition. Any cracked or otherwise damaged units shall not be accepted, nor shall any reimbursement be made for delivery or pick-up of damaged units.

B. Handholes shall be installed so that the cover is level at flush with grade.

C. All conduits entering manhole/handhole shall be installed in the provided terminators or in individually bored holes. Conduits installed in bored holes shall be properly spaced, cut flush with the interior face of the wall and shall be grouted from the outside of the manhole.

D. Fiberglass handholes shall be installed flush in concrete slab or in soil. Boxes shall be drilled and tapped for conduit entrance as shown on the drawings.

E. Provide 12 inches of pea stone as a base for open bottom handholes. Gravel shall cover surface area and 3 inches around perimeter of bottom of the handholes.

F. Backfill and properly grade fill flush with top of handholes.

G. Minimum earth cover for conduits entering manholes shall be 24 inches.

END OF SECTION

SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes electrical identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:
   1. Buried electrical line warnings.
   2. Identification labeling for raceways, cables, and conductors.
   3. Operational instruction signs.
   4. Warning and caution signs.
   5. Equipment labels and signs.
   6. Spare future conduits.

B. Refer to other Division 16 sections for additional specific electrical identification associated with specific items.

1.02 SUBMITTALS

A. Product Data: For each electrical identification product required on the project.

1.03 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.01 CABLE LABELS

A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letters.

C. Color: Black letters on white field.

D. Label Information: Indicate voltage and if applicable service.

2.02 NAMEPLATES AND SIGNS

A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in, or 8 inches in length; and 1/8 inch thick for larger sizes.

C. Color: Black letters on white face except for emergency systems listed in NFPA 70, Article 700, or as directed by the owner.

D. Nameplates shall be punched or drilled for mechanical fasteners.

E. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch grommets in corners for mounting.

F. Fasteners for Nameplates and Signs: Self-tapping, stainless steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.03 UNDERGROUND LABELS

A. Underground line marking tape: permanent, bright-colored, continuous printed, plastic tape compounded for direct-burial service not less than 6 inches wide by 4 mils thick. Printed legend indicative of general type of underground line below.

2.04 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Self-Adhesive Tape: Electronic Label Maker, imprinted, pressure-sensitive, abrasion-resistant plastic tape.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment, in accordance with manufacturer's written instructions and requirements of NEC.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding specified or indicated. Install numbers, lettering and colors as approved in submittals and as required by code.

C. Identify high-voltage feeder conduits (over 600V) by words "DANGER-HIGH VOLTAGE KEEP OUT" in black letters 2 inches tall, stenciled at 10-foot intervals over painted orange background.

D. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

E. Self-Adhesive Identification Products: Clean surfaces before applying.

F. Install nameplates and labels parallel to equipment lines.

G. Identify junction, pull and connection boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.

H. All surface and flush mounted wiring devices (light switches, receptacles, etc.) shall have the power circuit identified, in permanent marker or pen, on the back (inside) of the device cover plate.

I. Underground electrical line identification: During trench backfilling, for exterior underground power, signal and communication lines, install continuous underground plastic line marker, located 12 inches directly above conduit. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches: install a single line marker.

J. Labeling Legend: List panel and circuit number or equivalent in a legible manner.

K. Color-Coding of Secondary Phase Conductors: Refer to Section 26 05 19.

L. Wiring for control systems shall be color-coded in accordance with wiring diagrams furnished with the equipment.

M. Tag or label conductors as follows:
1. Future connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.
2. Multiple circuits: Where multiple branch circuits or control wiring or communications/signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by means of coded color of conductor insulation. For control and communication/ signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.

N. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:

O. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.

P. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

Q. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8 inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

R. Switch Identification Labels: Self-Adhesive Tape. Install on each switch when there are more than two switches under one faceplate or if switches are used to control exhaust fans or other equipment. Unless otherwise indicated, provide a single line of text with 1⁄8-inch high black lettering on clear background. Label shall indicate load controlled.

S. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

T. Furnish and install a sign at the service entrance equipment indicating type and locations of on-site emergency power sources. Sign shall be 8x10-inch minimum size mounted on the face on the switchboard.

U. Provide suitable permanent means of labeling spare conduits. Provide legible means of identifying the location of where each conduit originates. Provide the same identification at each end.

V. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-

explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch high lettering on 1-1/2 inch high label; where two lines of text are required, use labels 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories (not all categories may be required on the project) of equipment using mechanical fasteners:

1. Panelboards, electrical cabinets, and enclosures. Include series rated labeling per NEC Code or otherwise required.
2. Access doors and panels for concealed electrical items.
3. Control panels and enclosure.
4. Emergency system boxes and enclosures.
5. Motor-control centers.
6. Disconnect switches.
7. Enclosed circuit breakers.
8. Motor starters.
9. Push-button stations.
10. Contactors.
11. Remote-controlled switches.
12. Control devices.
13. Transformers.
14. Variable frequency drives.
15. Power generating units.
16. Control and timing relays
17. Timers/time clocks.

END OF SECTION

SECTION 26 22 13
LOW VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work of this section includes low voltage transformers as provided in this project.

1.02 REFERENCES:

A. (UL) - Underwriters' Laboratories.

B. (ANSI) - American National Standards Institute.

1.03 SUBMITTALS:

A. Submit under provisions of Division 1.

B. Shop drawings shall be submitted to the Engineer for his review prior to shipment of the unit.

C. Product Data shall be provided including the following information.
1. Transformer oil dielectric tests
2. Noise level tests
3. BIL impulse verification test
4. Percent impedance.
5. Percent regulation at unity power factor
6. Winding losses
7. Core losses
8. Percent excitation current
9. Resistance tests
10. Polarity and phase relation tests
11. Temperature rise tests
12. Corona tests

D. Include stated guaranteed efficiencies at full load, three quarter load, half-load, and one-quarter load. In addition, indicate the regulation at unity and 0.8 power factor along with no load losses.

1.04 DELIVERY, STORAGE AND HANDLING:

A. All shipping braces and supports shall be clearly identified for removal before energizing.

1.05 WARRANTY:

A. Transforming equipment shall have a 5-year equipment and labor warranty on parts workmanship.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. General Electric, Square D Co., ABB Power, Eaton, Cooper, and Siemens Energy & Automation, Inc.

2.02 DRY TYPE TRANSFORMERS:

A. Provide three phase and single phase transformers as specified with taps. Two (5%) full capacity taps below normal rated primary voltage, unless otherwise shown 10 KVA and smaller and with two 2-1/2% full capacity taps above and four 2-1/2% full capacity taps below primary voltage. Unless otherwise shown, and provide three phase transformer as follows:
1. 480 volt primary and,
2. 208Y/120 volt secondary or 120/240V secondary

B. Energy Efficiency Compliant: All dry type transformers larger than 15 kVA shall meet the efficiency standard established by the Department of Energy in 2016 (10 CFR Part 431).

C. Insulation System: Provide units insulated with a NEMA ST20 standard 220°C UL component insulation system, not to exceed 115°C rise above a 40°C ambient temperature under above full load conditions. Coils shall be continuous wound construction and impregnated with a non-hydroscopic thermosetting varnish.

D. Cores & Coils:
1. Manufacturer cores from high-grade non-aging grain oriented silicon steel with high magnetic permeability's, low hysteresis and eddy current losses.
2. Magnetic flux densities kept well below saturation to allow for a minimum 10% over voltage excitation.
3. Clamp cores with structural angles and bolt to the enclosure to prevent damage during shipment and handling.
4. Cores shall be wound with continuous copper or aluminum windings. Cores and coils shall be impregnated with non-hygroscopic, thermosetting varnish. Assembly shall be installed on vibration absorption pads.

E. Enclosures:
1. The enclosure shall be made of heavy gauge steel and shall be degreased, cleaned, primed, and finished with ANSI 61 color weather-resistant enamel. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90°C. The core of the transformer shall be visibly grounded to the enclosure.
2. On units rated below 30 KVA, the enclosure construction shall be totally enclosed, non-ventilated, NEMA 3R or ventilated NEMA 2.
3. On units rated 30 KVA and above, the enclosure construction shall be ventilated, NEMA 2, drip-proof, with lifting holes. All ventilation openings shall be protected against falling dirt. On outdoor units, provide suitable weather shields over ventilation openings.
4. The maximum temperature of the top of the enclosure shall not exceed 35°C rise over a 40°C ambient.

F. Sound Levels:
1. Guaranteed by manufacturer (and substantiated by certified tests on like unit.)
2. Sound Level Values.
   a. Up to 9 KVA 40 db.
   b. Through 50 KVA 45 db.
   c. Through 150 KVA 50 db.

G. Construction:
1. Transformer shall be pad mounted.
2. Enclosure shall be constructed of minimum 14-gauge steel.

3. It shall have a solid drip proof top and be mounted on a sufficient strength to permit jacking, rolling, and skidding.
4. Bolted removable panels shall be provided for easy access to top connections, enclosed terminals, and accessory equipment.

H. The following factory tests shall be performed on all transformers:
1. Ratio tests on the rated voltage connection and on all tap connections.
2. Polarity and phase-relation tests on the rated voltage connection.
3. Applied potential tests.
4. Induced potential test.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Transformers shall be mounted to align with conduits stubbing up into its line compartments were applicable.
1. Transformer shall be properly grounded to ground grid with copper wire as noted on plans.
2. Shims shall be placed under all four sides of any transformer that does not have legs.
3. Final cable terminations shall not be made until Owner required testing is complete.
4. Terminations shall not be tightened to manufacturer's specifications to avoid cracking bushings.

3.02 FIELD TESTING AND QUALITY CONTROL:

A. Provide for the services of a factory-authorized representative to supervise field assembly and connection of components, adjustments and per-testing of transformer.

B. Insulation Resistance Tests: Perform a megohmmeter test on the primary and secondary winding-to-winding and winding-to-ground from a minimum of ten minutes according to the following:

Winding Rating (Volts)	Minimum Test Volts (D.C.)	Minimum Insulation Resistance (Megaohms)	
		Dry Type	Liquid-Filled
0 – 600	1,000	500	100
601 – 5,000	2,000	5,000	1,000
5,000 – 35,000	5,000	25,000	5,000

C. Provide copy of test results to the engineer and in the O&M manuals submitted to the OWNER at project completion.

D. Visual and Mechanical Inspection
1. Document equipment nameplate data on the test report. Verify transformer nameplate ratings are in accordance with drawings and specifications.
2. Inspect the physical and mechanical condition of the equipment.
3. Verify that resilient mounts are free and that any shipping brackets have been removed.
4. Verify the proper selection and operation of the electrical test equipment. Record the date of the last calibration date and the date re-calibration is due.
5. Perform insulation-resistance tests, winding-to-winding, and each winding-to-ground with the test voltage in accordance with manufacturer's requirements. Test duration shall be for ten minutes with resistances tabulated at 30 seconds, one

minute, and ten minutes.

6. Perform a transformer turns-ratio test on all no-load tap-changer positions and all load tap-changer positions. Verify tap setting is as specified. Verify winding polarities are in accordance with nameplate.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work of this section includes panelboards wall mounted and in MCC compartments .

1.02 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Shop drawings.

C. Product Data:
1. Circuit breakers
2. Ground fault sensor
3. Current and voltage transformers
4. Metering devices, relays, switches

PART 2 - PRODUCTS

2.01 CIRCUIT BREAKER PANELBOARDS:

A. Provide UL listed and labeled, dead front type with box minimum of 20 inches wide by 5-3/4 inches deep of not less than #14 gauge galvanized steel. The front plate and door shall be of #12 gauge steel.

B. Provide panelboard NEMA surface mounted complete with panel trim having concealed hinges and trim mounting screws, locking door with flush catch.

C. Single box with common front painted to match trim. Provide ample wiring gutter in accordance with National Electrical Code.

D. Panelboard shall be unassembled with gray baked enamel finish.

E. 120-/240 Volt single phase, 3 wire, solid neutral design with sequence style bussing and full capacity neutral, composed of an assembly of bolt-in-place molded case automatic air circuit breakers with thermal and magnetic trip and trip free position separate from either "ON" or "OFF" positions. Provide interrupting rating as noted on the drawings.

F. 120/208V, 3 phase, 4 wire circuit solid neutral design, composed of an assembly of plug-in type molded case automatic air circuit breakers with thermal and magnetic trip and trip free position separate from either ON or OFF positions. Provide common simultaneous trip for 2 and 3 pole breakers. Provide interrupting rating as noted on the drawings.

G. 480V, 3 phase, 3 wire circuit, composed of an assembly of plug-in type molded case automatic air circuit breakers with thermal and magnetic trip and trip free position separate from either ON or OFF positions. Provide common simultaneous trip for 2 and 3 pole breakers. Provide interrupting rating as noted on the drawings.

H. Main bus to be tin plated aluminum rectangular in cross section and of full length.

I. Ground fault interrupting type shall be on circuits where receptacles are outdoors or in wet areas.

J. Each panelboard shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one (1) conductor shall be installed per lug.

K. Provide locking devices on circuit breakers as shown on panel schedules.

L. Minimum circuit breaker trip rating shall be 15 amps for power and lighting as shown on panel schedules.

M. Provide mounting brackets, busbar drillings, and filler pieces for unused spaces.

N. The panelboards shall be manufactured by Square D, Eaton, or Siemens.

O. Panelboard schedules are shown on the drawings.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. All wiring terminations to be marked as to wire number or circuit number.

B. Prepare and affix typewritten directory to inside cover of panelboards indicating loads controlled by each circuit.

C. Panelboards to be mounted on wall square with building lines.

END OF SECTION

SECTION 26 24 19
MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The work of this section includes modifications to existing motor control centers MCC-1 & MCC-2 at the Biopure Treatment Facility and related components.

B. The existing MCCs are Eaton Freedom Series 2100 motor control centers. Refer to the drawings for specific electrical requirements. All retrofit compartments shall be compatible with the motor control center type and ratings.

1.02 RELATED SECTIONS:

A. Section 26 05 00 - Electrical General Provisions

B. Section 26 22 13 - Low Voltage Transformers

C. Section 26 24 16 - Panelboards

D. Section 26 28 17 - Circuit Breakers

1.03 SUBMITTALS:

A. Submit for review/approval under provisions of Section 01 33 00 - Submittals and include the following:
   1. Master drawing index.
   2. Unit wiring diagrams.
   3. Nameplate information
   4. Starter and component schedule
   5. Assembly ratings including:
      a. Short-circuit rating
      b. Voltage
      c. Continuous current
   6. Major component ratings including:
      a. Voltage
      b. Continuous current
      c. Interrupting ratings
   7. Cable terminal sizes
   8. Product data sheets including but not limit to data for:
      a. Circuit breakers (motor circuit protectors)
      b. Control transformers
      c. Overload relays
      d. Motor starters, contactors
      e. Pushbuttons, selector switches and lights
      f. Phase Failure Relay compartment

B. Submit for construction under provisions of Section 01 33 00 - Submittals the following:
   1. Final as-built drawings and information for items listed in paragraph 1.03.A, and shall incorporate all changes made during the manufacturing process.
   2. Unit wiring diagrams.
   3. Certified production test reports confirming motor control center ratings and conformance to test standards.
   4. Installation information.
   5. Seismic certification and equipment anchorage details.

C. Provide Operation and Maintenance Manuals including renewal parts for motor starters and all sub-components in the assembly.

D. Provide Submittal Documents within six (6) weeks of Notice to Proceed.

1.04 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code (IBC) for zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, IBC: a peak of 2.45g's (3.2-11 Hz), and a ZPA of 0.98g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

1.05 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

B. Provide a clearly labeled and identified copy of the program, configuration and parameter settings for each soft starter unit in the MCC.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Compartment units and accessories shall be by Eaton.

2.02 MOTOR CONTROL CENTERS (EXISTING):

A. MCC is a free standing, totally enclosed, dead front NEMA type 1 enclosure. One or more vertical sections shall be bolted together to form a rigid assembly, designed to permit future additions, changes, or regrouping of units and comply with NEMA standards publication number ICS-2-322 and Underwriters Laboratory publication number 845.

B. MCC assemblies have a fault current interrupting rating of 65,000 amps.

C. Operating voltage shall be 480 volts, three-phase, 3 wire, 60 Hertz with 120 volts, 60 Hertz control voltage provided by individual control transformers. Provide a 24VDC power supply in each reduced voltage soft starter bucket for starter control circuit.

D. Provide plug-on type unit connections to energized bus bars.
   1. Provide high quality 2-point connection for each phase, designed to tighten during heavy current surge. They shall have silver plated plug-in fingers.
   2. Provide spring steel backing clips to ensure high pressure connection points.
   3. Mount contact fingers in their supports so they become floating and self-aligning to allow solid seating on to vertical bus bars.

E. Provide each unit with securely mounted hinged doors fastened to stationary structures so that they can be closed when unit is removed.
   1. Provide removable door panels held with captive screws for starter unit doors for mounting push buttons, selector switches, and pilot lights.
   2. Provide blank door panels capable of accepting future push button devices when push button devices are not originally specified for starter unit.
   3. Provide starter units with external low profile overload reset button.
   4. Provide unit running full voltage push-to-test type green pilot light for each starter.

F. Plug-in units of the same size shall be interchangeable for easy unit rearrangement.

G. Provide each plug-in unit with a sheet steel saddle to isolate the equipment from the bus compartment and adjacent units.
   1. Equip saddles with captive, self-aligning mounting screws which will hold the unit in place during shipping and so maintain unit and structure at same potential.
   2. Provide hand holes on each plug-in unit for easy unit removal.
   3. Equip saddle with a provision to permit it to be padlocked in the section in a position such that the contact fingers are disengaged from the bus bars.

H. Provide a rugged, flange mounted operator handle for each switch.
   1. Handle shall be engaged with the switch at all times regardless of unit door position.
   2. Handle shall have conventional up-down motion with "OFF" in the down position and have facility for locking handle in the "OFF" position with padlock having up to 3/8" diameter shackle.
   3. Interconnect operator handle with unit door so that disconnect cannot be switched to "ON" unless unit door is closed.
   4. Interlock shall also prevent opening of unit door until disconnect is in "OFF" position.
   5. Interlock shall be capable of being defeated by a maintenance electrician without disruption of service.

I. Combination motor starter compartment shall be equipped as follows:
   1. Provide motor circuit protector or thermal magnetic circuit breaker with ratings shown on the drawing.
   2. Starters shall be NEMA Type related to size, horsepower and contact rating required for the motor load it is serving.
   3. Starter shall have double break silver alloy contacts through NEMA size 4 and single break in NEMA size 5 and larger which shall be replaceable without removing any power wiring or the starter.
   4. Coils to be molded construction and replaceable from the front without removing the starter.
   5. Provide bi-metallic thermal overload elements with replaceable and interchangeable heater module which shall be removable from the front of the starter. Unit shall be capable of manual reset from front of starter enclosure and shall be "Trip Free" not allowing the overload control contacts to reclose or render harm to the overload relay if manual reset is attempted before cooling of the thermal element has occurred. Removal of the heater module shall render the starter inoperable.
   6. Shall have suitable space for the addition of auxiliary contacts of any arrangement of normally open or normally closed. Starter unit shall accept 4 contacts. These contacts shall be in addition to the normal "seal in" contact. Auxiliary contacts which shall be provided are as follows: 2-N.O. and 2-N.C.
   7. On the front of the enclosure, provide a three position Hand-Off-Auto selector switch with a green push-to-test running pilot light, and a red push-to-test pilot light indicating unit stopped.

8. Provide a control circuit transformer of ample capacity with an extra 100 VA to operate the control circuit at 120 volt for units with compartment heaters or field wired motorized dampers. Control transformer shall include two primary fuses and one secondary fuse.
9. Control circuits and relays shall be provided as shown on drawings with contacts rated not less than 120 volts, 10 amperes.

J. Combination Solid State Reduced Voltage Starters (RVSS) (Soft Starters) shall be equipped as follows:
1. Provide thermal magnetic circuit breaker with ratings shown on the drawing. Magnetic trip style motor circuit protector is acceptable if sized for proper motor and soft starter application.
2. Starter shall be sized in horsepower and contact rating required for the motor load it is serving.
3. Provide each RVSS with a control power transformer of ample capacity with an extra 250 VA to operate the control circuits and motor space heaters at 120 volt. Control power transformer shall include two primary fuses and one secondary fuse.
4. Provide properly sized thermal magnetic breaker or motor circuit protector on the incoming line side of the power to the starter.
5. Control circuits and relays shall be provided as shown on drawings with contacts rated not less than 120 volts, 10 amperes.
6. Provide a three position Hand-Off-Auto selector switch, OFF pilot light, ON pilot and elapsed time meter on the front of the RVSS compartment door.
7. The starter controller shall include the following features:
   a. Integrated bypass contactor that is closed once the motor is up to full speed.
   b. Pump control application firmware.
   c. Electronic overload protection with adjustable trip class
   d. Four programmable auxiliary contacts
   e. Selectable control capabilities: soft start, kickstart, current limit start, dual ramp, full voltage, linear speed, preset slow speed, soft stop
   f. LCD display with keypad for programming and configuration mounted on the front of the RVSS compartment door.
   g. Built-in, selectable protective functions for: overload, jam, stall, excessive starts per hour, underload, over/under voltage, voltage unbalance
   h. Metering capabilities for: current, voltage, kW, kWH, power factor, motor thermal capacity utilized, elapsed time
8. The unit shall be provided with line side protective modules. The modules shall contain capacitors and metal oxide varistors (MOVs) that protect the internal power circuitry from severe electrical transients and/or high electrical noise.
9. Provide door-mounted pilot devices as shown on the contract drawing wiring diagrams.
10. Emergency run bypass contactor is not required.
11. Disconnecting means for solid-state controllers shall be a circuit breaker or motor circuit protector. Short circuit rating shall be 65,000 A (rms symmetrical)
12. Starter design is based on Eaton S811+ model Reduced Voltage Soft Starter.
13. Manufacturers: Eaton S811+ model or approved equal.

K. Provide NEMA Class I Type B wiring with quick separating, pull-apart terminals mounted on lift-out brackets in the units.

L. Phosphatizing treatment shall be followed by baked-on enamel giving a durable, hard final finish. Paint unit saddles white. Paint other parts ANSI-49 medium light gray.

M. Nameplates shall be minimum 1 inch x 3 inch white plastic with engraved black lettering. Letters shall be a minimum of 1/8" high.

N. Pilot lights shall be 24VDC or 120VAC, 60 Hertz, as required by the application, push-to-test type, with plastic lens and color matched rings. If special tools are needed for lamp replacement, furnish same.

O. Selector switches and push buttons shall be rated for 120VAC, 10 amperes, 60 Hertz, or 24VDC, as required by the application, with maintained or momentary contacts as required, oil-tight and provide with legend plates, as on all switches as depicted on the drawings.

P. Provide separate wire labels for all compartment control and signal wiring per Section 26 05 53. Using terminal block labeling only or preprinted numbers on wire insulation is not acceptable.

Q. Provide an electromechanical non-resettable elapsed runtime meter at each motor starter section indicating motor elapsed runtime.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install in accordance with drawings, shop drawings, and manufacturer's recommendations.

B. All wiring terminations shall be marked as to wire number or circuit number as noted on drawings.

C. Bus interconnections shall be torqued to manufacturer's specifications.

D. Connect controls in accordance with wiring diagrams.

E. Select overload relay heaters to provide proper motor overload protection in accordance with NEC considering motor service factor, temperature rise, ambient temperatures and other applicable factors.

F. Final feeder cable or bus terminations shall not be made until all owner required testing is complete.

G. Provide the services of a qualified factory-trained manufacturer’s representative to assist the contractor in installation and startup of the equipment specified under this section for a period of 1 working day per MCC. The manufacturer’s representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

H. The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer’s service representative:
1. Check all removable cells and starter units for easy removal and insertion
2. Perform insulation tests on each phase and verify low-resistance ground connection on ground bus
3. Connect all power wiring and control wiring and verify basic operation of each starter from control power source Torque all bolted connections made in the field and verify all factory bolted connections
4. Calibrate any solid-state metering or control relays for their intended purpose and make written notations of adjustments on record drawings. Perform startup of any solid-state starters and adjustable frequency drives
5. The Contractor shall provide three (3) copies of the manufacturer’s field startup report.

I. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations. Equipment shall be inspected prior to the generation of any reports. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

3.02 TRAINING

A. The Contractor shall provide a training session for up to five (5) Owner's representatives for one normal workday per MCC at the jobsite or other office location chosen by the Owner.

B. A manufacturer's qualified representative shall conduct the training session.

C. The training program shall consist of the following:
1. Review of the MCC one-line drawings and schedules.
2. Review of the factory record shop drawings and placement of the various cells.
3. Review of each type of starter cell, components within, control, and power wiring.
4. Review of soft starter configuration, parameters and programming
5. Review contactor coil replacement and contact replacement procedures.
6. Discuss the maintenance timetable and procedures to be followed in an ongoing maintenance program.
7. Provide three-ring binders to participants complete with drawings, instruction books, operation and maintenance manuals and other course material covered. All drawings, instruction books, operation and maintenance manuals shall be original bound factory printed materials. Photocopies of such materials shall NOT be allowed.

3.03 SPARE PARTS:

A. Provide a complete list of manufacturer's recommended spare parts for the maintenance of the equipment including, but not limited to, control transformers, moving and stationary contacts, auxiliary interlocks, relays, lamps for indicating lights, coils, disconnect switches, etc.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Wiring devices including but not limited to receptacles, power receptacles, light switches, wall plates, cover plates, GFIC receptacles, pushbuttons, thermostats and selector switches.

1.02 RELATED SECTIONS:

A. Section 26 05 34 - Electrical Boxes.

1.03 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Product data of all types of items supplied.

C. Submit sample cover plates to Owner for approval prior to installation.

PART 2 - PRODUCTS

2.01 WALL SWITCHES:

A. 120/277 Volt Switches (not interfaced with energy management system): Premium Industrial Specification grade, toggle handle, with totally enclosed case, rated 20 ampere, tungsten, 60 Hertz. Switches to be Hubbell # 1221 or equal by Leviton, Cooper Wiring, or GE. Provide matching 2 pole, 3 way and 4 way switches.

B. Explosion-proof 120/277 Volt Switches: Factory sealed with pre-wired pigtail leads, rated 20 ampere, front-operating rocker arm handle, switch enclosed in separate sealing chamber, internal ground screw, 1-pole, 3-way and 4-way.

C. Switch and Pilot Light: Toggle action type with red handle, integral long-life neon pilot light, rated at 20 ampere, 120 volts.

D. Color:
1. Black.

2.02 RECEPTACLES:

A. Standard duplex receptacles shall be specification grade, full gang size, polarized, duplex, parallel blade, rated at 15 amperes, 120 volts, conform to NEMA 5-15R and Federal Specification W-C-596. Receptacles shall be Hubbell 5262 or equal by Leviton or GE.

B. Standard duplex receptacles shall be specification grade, full gang size polarized, duplex, parallel blades, grounding type, rated at 20 ampere, 120V conforming to NEMA (5-20R). Receptacles shall be Hubbell 5362 or equal by Leviton or GE.

C. Standard single receptacle shall be specification grade, full gang size polarized, parallel blades, grounding type, rated at 2-pole, 3 wire 20 ampere, 240V conforming to NEMA (6-20R). Receptacles shall be Hubbell 5461 or equal by Leviton, Cooper.

D. Ground fault receptacle shall be UL listed Class A with 5 milli ampere sensitivity 20 ampere, 120 VAC, grounded, NEMA 5-20R. Receptacle shall have test and reset buttons integral with receptacle. Receptacles shall be Hubbell 5461 or equal by Leviton or GE.

E. Explosion-proof receptacles shall be rated for use in Class I, Division I, Group D locations. Receptacles shall be rated for 20 amperes at 120 volts, "dead front" type, malleable iron construction with hinged spring door. Receptacles shall be Appleton Type CPS or equal by Cooper Crouse-Hinds.

F. Weatherproof receptacles shall be ground fault type duplex receptacles with weatherproof covers, which allow for complete coverage of receptacle during use. Receptacles shall be Hubbell model GFRST or approved equal.

G. Color:
1. Black - Indoor.

2.03 COVER PLATES:

A. Provide for standard switches and receptacles for main level areas unless noted otherwise. Cover plates to be brushed stainless steel 302.

B. Provide weatherproof rated gray switch coverplates for light switches located outdoors. Plate type based on a Hubbell HBL1795 or equal.

C. Provide weatherproof rated gray receptacle coverplates for receptacles located outdoors. Plate type based on a Hubbell WP26E or equal.

2.04 FUSED SWITCHES:

A. Fused switch unit shall be for 120VAC, single-phase fans associated with unit heaters, cabinet heaters, etc.

B. Switch shall be integral with a standard two-gang stamp steel junction box cover with integral fuse holder and fuse cover. Switch shall be rated for 120VAC, 15A. Switch unit type shall be Bussmann type SSY or approved equal.

2.05 PUSHBUTTON AND SELECTOR SWITCHES:

A. Refer to Section 40 95 10 for specification requirements related to push buttons, selector switches, and pilot lights.

2.06 SURGE SUPPRESSION RECEPTACLE:

A. Shall be 1-pole, 2-wire nylon grounding receptacles complying with U.L. Listed 1449 & 498, NEMA 5-20R configuration. Shall come equipped with power-on indicator light which indicates power is available and the surge suppression is functioning properly.

B. Receptacles shall be Hubbell # HBL5360SA or equal by Cooper Wiring Premium Industrial Specification Grade and wall plate #SPJ26 with a limited ten-year warranty.

2.07 LINE VOLTAGE THERMOSTATS:

A. Thermostats controlling heaters and cooling fans shall be heavy duty line voltage rated 16 amps at 120V for pilot duty sized for the contactor coil load, adjustable range 45° to 85°F with adjustable dead band range of 0-3 degrees.

B. Single pole, double throw suitable for operating as a two-stage cooling thermostat energizing the electric cooling load on rising temperatures.

C. The thermostat shall be Chromalox type WR80 or equal by Honeywell. In Class 1 Div I areas thermostats shall be Chromalox type EPETD-8D or equivalent.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Mount wall switches 42 inches to bottom above finished floor.

B. Mount line voltage thermostats 60" to bottom above the finish floor in flush wall boxes.

C. Coordinate switch-mounting location with architectural detail.

D. Mount receptacles 16" to bottom above finished floor or as noted on the drawings.

E. Install cover plates on all wiring devices.

F. The outdoor units to be enclosed in cast aluminum boxes with cast aluminum, weatherproof cover plates.

G. Where more than one wall switch is installed in the same location, set under one cover plate.

H. Provide permanent barriers between adjacent switches on 240-volt service.

I. Install in accordance with drawings, submittals, and manufacturer's recommendations.

END OF SECTION

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SECTION 26 28 13
FUSES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work of this section includes fuses and fuse holders.

1.02 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Product data.

C. Time current curves and current limitation curves for fuses.

PART 2 - PRODUCTS

2.01 GENERAL:

A. All fuses shall be UL listed, current limiting type, with high interrupting capacity.

B. All fuse contact surfaces shall be plated.

C. Fuses shall be selected to provide a fully selective system.

2.02 MANUFACTURERS:

A. Fuses shall be Gould Shawmut or Bussman.

2.03 TRANSFORMER PROTECTION FUSES:

A. Low Voltage (600 VAC or less):
1. Above 600A: Provide Class L fuses for low voltage transformers rated above 600A.
2. 600A or less: Provide Class RK5, time delay type fuses for low voltage transformers rated 600A or less.
3. All fuses shall have 200,000 amperes RMS interrupting rating.

B. Control Circuit (600 VAC or less): Provide Class CC for control circuit transformers rated 600 VAC or less. Fuses shall have 200,000 amperes RMS interrupting rating.

2.04 MOTOR PROTECTION FUSES:

A. Low Voltage (600 VAC or less): Provide time delay type, Class RK-5 (if more current limitation is required, provide Class RK-1 or Class J) fuses for short-circuit protection of low voltage motors and motor controllers. Fuses shall have 200,000 amperes RMS interrupting rating.

2.05 MAIN CIRCUIT PROTECTION FUSES:

A. Above 600 A: Provide Class L fuses for service entrance and feeder circuits rated above 600 A.

B. 600 A or less: Provide Class J or Class RK1, time delay type fuses for service entrance and feeder circuit rated 600 A or less.

C. All fuses shall have 200,000 amperes RMS interrupting rating.

2.06 FUSE HOLDERS:

A. Wire connectors shall be box type - most durable and versatile, for stranded or solid wire.

B. Fuse block insulators shall be molded polycarbonate type. All insulators shall meet voltage clearance and creepage requirements of UL for general industrial control equipment.

C. Fuse clips shall be standard clips - cover all ratings 30-600 amperes spring reinforced with rejection feature for Class R fuses.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Fuses to be properly mounted or bolted into their fuseholder so as to maintain proper continuity.

B. Fuses and fuseholders shall be sized according to the NEC.

C. Coordination with other protective devices shall be accomplished by using proper time-current curves.

END OF SECTION

SECTION 26 28 16
MOTOR & CIRCUIT DISCONNECTS

PART 1 – GENERAL

1.01 DESCRIPTION:

A. Work of this section includes motor and general circuit disconnects including separately mounted disconnects and those mounted in motor control centers.

1.02 RELATED SECTIONS:

A. Section 26 28 13 - Fuses

1.03 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Provide shop drawings and product data for disconnects including outline and mounting dimensions, wiring schematic diagrams, short circuit current with-stand ability ratings.

C. Provide operational and maintenance data including renewal parts for all disconnects.

PART 2 - PRODUCTS

2.01 DISCONNECT SWITCHES:

A. Provide disconnect switches with switch blades fully visible in "OFF" position, rated NEMA type HD, Underwriters Laboratory listed, with quick-make, quick-break operation handle, and mechanism forming an integral part of the box, not in the cover. All current carrying parts shall be plated to resist corrosion and have cool operation. The switches to have dual cover interlock to prevent unauthorized opening of door in the "ON" position or closing switch with door open. Provide padlocking provisions to allow at least three (3) padlocks to prevent switch operation in the "OFF" position. Provide safety switches, fused, non-fused to horsepower rated, as required.

B. Switches shall have NEMA 1 or NEMA 3R rainproof enclosure. Where shown on NEMA 3R enclosure, covers to be securable in open position. The disconnect switch type enclosures shall be made of the following steel: NEMA 1 - Code gauge (UL 90) sheet steel; NEMA 3R - Code gauge (UL 98) galvanized steel. All enclosures to be given a rust-inhibitive phosphate treatment and then a coat of baked-on-gray enamel.

C. Provide fusible disconnect switches with clips for fuses which have UL listed short circuit rating of 200,000 rms symmetrical amperes when Class R or Class J fuses are used.

D. In outdoor or wet locations areas, specifically around the aeration ponds and lagoons, the disconnect switch enclosures and operators shall be of stainless steel or non-metallic, corrosion resistant, with stainless steel hardware and be gasketed to protect the exterior mechanisms. Switches shall be NEMA 4X rated.

E. Disconnect switches shall be provided with mechanical type lugs suitable for the conductors used.

F. Service entrance safety switch shall be a fusible double-throw safety switch with the following features, if applicable:
1. Switch shall be UL listed as suitable for use as service entrance equipment.
2. Switch shall have a UL listed short circuit rating of 200 kA with R, J or T fuses.
3. Three-phase with neutral assembly included.

G. Acceptable Manufacturers:
1. Square D, Eaton, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install motor and circuit disconnects in accordance with manufacturers recommendations and applicable codes.

B. Provide fuses of required rating in each fused switch.

C. Inspect all disconnect devices for damage. Verify operation of the disconnect switch prior to energizing or adding load.

END OF SECTION

SECTION 26 28 17
CIRCUIT BREAKERS

PART 1 – GENERAL

1.01 DESCRIPTION:

A. Work of this section includes circuit breakers and their related enclosures.

1.02 RELATED SECTIONS:

A. Section 40 95 10 - Lift Station Control Panels.

1.03 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Product data including applicable shop drawings.

C. Coordination and characteristic curves for circuit breakers.

D. Test reports.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Molded Case Circuit Breakers:
1. 120, 208, 277, 480 volt.
2. 50, 100, 250, 400 ampere frame.
3. Less than 400 continuous ampere rating, thermal magnetic trip unit.
4. 400 to 800 continuous amp rating, electronic trip unit (LSI), or as noted on the drawings.
5. Above 800 continuous amp rating, electronic trip unit (LSIG), or as noted on the drawings
6. 1, 2, and 3 pole.
7. Interrupting current rating as noted on the schedules.
8. Ground fault interrupters with 4-6 mA sensitivity.
9. Trip free mechanism.
10. Quick make, quick break mechanism.
11. Plug-in line bus connected.

B. Motor Circuit Protectors:
1. 480 volt.
2. 50, 100, 225 ampere frame.
3. continuous ampere rating as required for load size.
4. Instantaneous adjustable trip range with lockable positions.
5. 2, 3 pole.
6. 35,000A interrupting rating.

C. Options Available for Circuit Breakers:
1. Line and load lugs suitable for use with copper conductors with standard copper pressure, set screw fastening, aluminum alloy, terminals.
2. Mechanical interlocking of walking beam or sliding bar type.
3. Enclosure of NEMA Type 1.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Circuit breakers to be mounted in enclosures, panels, load centers, motor control centers, or switchgear.

B. Enclosure for circuit breaker shall be properly grounded.

C. Attach handles so as to not interfere with cover plate or door.

D. Properly mount circuit breaker so acceptable electrical connection is made to bus work.

E. Terminations to breaker terminals shall be to industry standards.

END OF SECTION

SECTION 26 29 13
MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The work of this section includes separately mounted motor starters.

1.02 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Provide shop drawings for motor starters separately mounted including outline and wiring diagrams.

C. Provide Product Data including:
1. Outline mounting dimensions and wiring diagrams.
2. Component layout.
3. Motor starter contactor.
4. NEMA starter size.
5. Control transformer.
6. Overload relay.
7. Overcurrent disconnects device data.
8. Push buttons, selector switches and pilot lights.

D. Provide operation and maintenance data including renewal parts for all starters. Include listing of each application showing motor nameplate details, starter size and type, and overload heater sizing.

PART 2 - PRODUCTS

2.01 MANUAL MOTOR STARTERS:

A. Manual starters shall be used only on single-phase fractional (1/2 or less) horsepower motors unless specifically noted otherwise on the drawings.

B. Toggle switch operated type equipped with (melting alloy) thermal overload relay which shall be one piece and allow use of interchangeable heater elements.

C. Reset device to be trip free operation, and render the starter inoperative if the interchangeable heater is removed.

D. The "ON" position located up toward the top of the enclosure.

E. Provide NEMA 1 enclosure for surface mounting with standard stainless steel flushplate.

F. Enclosure to be equipped with handle guard and provision for padlocking in OFF position.

G. Equipped with pilot light indicating when starter is in "ON" position.

H. Starter shall have an operating contact pole for each ungrounded conductor.

I. Acceptable Manufacturers: Eaton, Square D, Siemens, or Allen-Bradley.

2.02 COMBINATION MOTOR STARTERS:

A. Starters' contactor shall be NEMA type as shown on the drawings. IEC starter contactors are acceptable and shall be rated for the motor full load amp range as required.

B. Provide with motor circuit protector with ratings as shown on the drawings. Provide padlocking in "OFF" position. Operating voltage shall be 480 volt, 3 phase unless noted otherwise.

C. Provide NEMA 1 General Purpose Enclosure or as noted on the drawings. All combination starters shall be equipped with a manual disconnect switch with a pad-lockable 'off' position. Refer to Section 26 28 16 for disconnects specifications.

D. Starter shall have double break silver alloy contacts through NEMA size 3 which shall be replaceable without removing any power wiring or the starter.

E. Coils to be molded construction through NEMA size 5 (and form wound taped, varnished and baked on NEMA size 6 and larger) replaceable from the front without removing the starter.

F. Provide a solid-state adjustable overload relays which shall be removable from the front of the starter. Overload relay shall be equipped with a manual reset, test and stop buttons, and fault trip reason on the face of the relay. Relay shall be manually reset from front of starter enclosure and shall be "Trip Free" not allowing the overload relay control contacts to reclose or render harm to the motor load or starter. Relay shall provide current unbalance and ground fault protection for the motor. Relay shall have selectable starting class ratings and restart delay.

G. Shall have suitable space for the addition of auxiliary contacts of any arrangement of normally open or normally closed and shall accept 4 contacts. These contacts shall be in addition to the normal "seal in" contact. Auxiliary contacts which shall be provided are 2-NO and 2-N.C.

H. Provide a three position Hand-Off-Auto selector switch green transformer type run pilot light on the front of the enclosure.

I. Provide a control circuit transformer of ample capacity (minimum 50VA) to operate the control circuit at 120 volt. Control transformer shall include two (2) primary fuses and one (1) secondary fuse.

J. Control circuits and relays shall be provided as shown on drawings with contacts rated not less than 120 volts, 10 amperes.

K. Mechanical interlocks shall be provided to prevent access to inside of starter cabinet by unauthorized personnel when switch is in "ON" position.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install in accordance with manufacturer recommendations and applicable codes.

B. Configure overload relays to provide proper motor overload protection in accordance with NEC considering motor service factor, temperature rise, ambient temperatures and other applicable factors. Configure restart time delay to "stagger" equipment restart on return to power after power failure.

C. Connect controls in accordance with wiring diagrams.

3.02 VISUAL AND MECHANICAL INSPECTION:

A. Document equipment nameplate data on test report. Verify equipment nameplate ratings are in accordance with drawings and specifications. This will include: contactor, fuses, overloads, circuit breakers, overload relay heaters, and the control power transformer.

B. Inspect the physical and mechanical condition of the equipment. Do not conduct any electrical tests until operation

3.03 ELECTRICAL TESTS:

A. NOTE: When performing dielectric tests, you must disconnect all Instrument and Control Transformers, Arresters, TVSS units, and other sensitive electronic equipment that may cause erroneous results or cause damage to equipment that is not rated in accordance with the equipment standards.

B. Electrical tests shall not be performed on single-phase manual motor starters.

C. Perform operational tests by initiating control devices.

D. Verify proper phase rotation of motor load and swap conductors on control contactor as required.

E. Test the motor overload relay elements by injecting primary current through the overload circuit, and monitoring the trip time of the overload element.

END OF SECTION

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SECTION 26 29 23
VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The work of this section includes variable frequency drive controllers for the purpose of varying the speed of fans and pumps.

1.02 REFERENCES:

A. Applicable Standards and Codes:
1. National Board of Fire Underwriters (NBFU).
2. National Electrical Contractors "Standard of Installation" (NECA).
3. Institute of Electrical & Electronic Engineers (IEEE).
4. National Electrical Code (NEC).
5. National Electrical Manufacturers Association (NEMA).
6. National Fire Protection Association (NFPA).
7. Underwriters' Laboratories, Inc. (UL).

1.03 SUBMITTALS:

A. Submit under provisions of Division 1.

B. Provide detailed product data on each type of drive controller proposed. Data to be included:
1. Design type with components used.
2. Performance details including
a. Allowable electrical input parameters
b. Speed regulation
c. Power factor
d. Harmonic output effect of harmonic to input line
e. Operating temperature
f. Required environment
g. Minimum and maximum speed setting
h. Linear acceleration and deceleration setting
i. Other adjustments.
3. Physical details including dimension and weights.
4. Statement of warranty.
5. Location of nearest in-warranty and out-of-warranty trained service labor and details of cost. Also include details on parts availability.
6. Complete circuit diagrams.

C. Submit resumes and qualifications of the Field Service Engineer(s) performing start-up, field testing, training and certification as specified below.

D. Total harmonic distortion shall be calculated under worst-case conditions in accordance with the procedure outlined in IEEE standard 519-1992. Submit distortion values and related information with drive submittal.

1.04 START-UP AND OPERATOR TRAINING:

A. The services of a competent experienced factory representative shall be provided to supervise start up and instruct the Owner's operating personnel. Scheduling and coordination of this service shall be by written request of the Construction Manager. This does not include travel to and from jobsite.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Design and specification are based on ABB ACS880 Series Drives. Alternate by ITT PumpSmart PS220, Square D Altivar 600 Series or Allen Bradley Powerflex 750 Series and must meet specifications, design intent, and installation space shown on the drawings.

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 CONSTRUCTION:

A. Where shown on the drawings, variable frequency drives 1 through 1100 hp shall have the following features:
1. Provide variable torque VFD's as noted on construction drawings.
2. The VFD shall be rated 480V AC. The VFD shall provide microprocessor-based sensorless vector and simple frequency control for three-phase induction motors.
3. The VFDs shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Adjustable Current Source VFDs are not acceptable. Insulated Gate Bipolar Transistors (IGBTs) shall be used in the inverter section. Bipolar Junction Transistors, GTOs or SCRs are not acceptable.
4. The VFDs shall have efficiency at full load and speed that exceeds 92% for VFDs below 15 Hp and 95% for drives 15 Hp and above. The efficiency shall exceed 90% at 50% speed and load.
5. The VFDs shall maintain the line side displacement power factor at no less than 0.96, regardless of speed and load.
6. The VFDs shall have a one (1) minute overload current rating of 150% for constant torque drives. The VFDs shall have a one (1) minute overload current rating of 110% for variable torque drives.
7. The VFDs shall be capable of operating of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the VFD.
8. The VFDs shall have an integral EMI/RFI filter as standard.
9. The VFD shall limit harmonic distortion reflected onto the utility system to a voltage and current level by utilizing the standard 3% nominal impedance, integral AC three-phase line reactor or harmonic filtering equipment integral to the MCC compartment.
10. The VFD shall be able to start into a spinning motor. The VFD shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the VFD shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.
11. For Open-Frame VFD provide with NEMA 12 conversion kits.

2.03 VARIABLE FREQUENCY DRIVE CONTROLS:

A. Frequently accessed VFD programmable parameters shall be adjustable from a digital operator keypad located on the front of the VFD. The VFDs shall have a minimum three-line alphanumeric programmable display with status indicators. Keypads must use plain English words for parameters, status, and diagnostic messages. Alphanumeric codes and tables are not acceptable.

B. Standard advanced programming and troubleshooting functions shall be available by using a personal computer's USB/Ethernet port and Windows® based software. In addition, the software shall permit control and monitoring of the VFD. The manufacturer shall supply the required software.

C. The operator shall be able to scroll through the keypad menu to choose between the following:
1. Monitor
2. Operate
3. Parameter setup
4. Actual parameter values
5. Active faults
6. Fault history
7. LCD contrast adjustment
8. Information to indicate the standard software and optional features software loaded.

D. The following setups and adjustments, at a minimum, are to be available:
1. Start/stop command from keypad, remote or communications port
2. Speed command from keypad, remote or communications port
3. Motor rotation selection
4. Maximum and minimum speed limits
5. Acceleration and deceleration times, two settable ranges
6. Critical (skip) frequency avoidance
7. Torque limit
8. Multiple attempt restart function
9. Multiple preset speeds adjustment
10. Catch a spinning motor start or normal start selection
11. Programmable analog output
12. DC brake current magnitude and time
13. Proportional/integral process controller.

2.04 SYSTEM INTERFACES:

A. Inputs - A minimum of six (6) programmable digital inputs, two (2) analog inputs and communication interface shall be provided with the following available as a minimum:
1. Remote manual/auto
2. Remote start/stop
3. Remote forward/reverse
4. Remote preset speeds
5. Remote external trip
6. Remote fault reset
7. Process control speed reference interface, 4-20 mAdc
8. Potentiometer and 1-10V DC speed reference interface
9. Programming and operation interface port
10. Communications port.

B. Outputs - A minimum of two (2) discrete programmable digital outputs, and one (1) programmable analog outputs shall be provided.

C. Programmable relay outputs with one (1) set of Form C contacts for each, selectable with the following available at minimum:
1. Fault
2. Run
3. Ready
4. Reversing

5. Jogging
6. At speed
7. In torque limit
8. Motor rotation direction opposite of commanded
9. Overtemperature.

D. Programmable analog output signals, selectable with the following available at minimum:
1. Output current
2. Output frequency
3. Motor speed
4. Motor torque
5. Motor power
6. Motor voltage
7. DC link voltage.

2.05 MONITORING AND DISPLAYS

A. The VFD's display shall be an LCD type capable of displaying three (3) lines of text and the following thirteen (13) status indicators:
1. Run
2. Forward
3. Reverse
4. Stop
5. Ready
6. Alarm
7. Fault
8. Local
9. Panel
10. Remote
11. Hand
12. Auto
13. Off.

B. The VFD's display shall be capable of displaying the following monitoring functions at a minimum:
1. Output frequency
2. Output speed
3. Motor current
4. Motor torque
5. Motor power
6. Motor voltage
7. DC-link voltage
8. Heatsink temperature
9. Total operating days counter
10. Operating hours (resettable)
11. Total megawatt hours
12. Megawatt hours (resettable)
13. Voltage level of analog input
14. Current level of analog input
15. Digital inputs status
16. Digital and relay outputs status
17. Motor temperature rise, percentage of allowable.
18. Protective functions
19. The VFD shall include the following protective features at minimum:
    a. Overcurrent
    b. Overvoltage

c. Inverter fault
d. Undervoltage
e. Phase loss
f. Output phase loss
g. Undertemperature
h. Overtemperature
i. Motor stalled
j. Motor overtemperature
k. Motor underload
l. Logic voltage failure
m. Microprocessor failure
n. DC injection braking.

C. The VFD shall provide ground fault protection during power-up, starting, and running. VFDs with no ground fault protection during running are not acceptable.

2.06 COMMUNICATIONS:

A. VFD shall have communications card and connections to communicate Ethernet TCP/IP.

2.07 DIAGNOSTIC FEATURES:

A. Record and log faults.

B. Indicate the most recent first, and store up to 9 faults.

2.08 ENCLOSURES:

A. The VFD enclosure shall be minimum IP 20 or in specialty engineered enclosure to house relays, timers, protection devices, etc., with a NEMA rating as noted or as shown and described on the drawings.

2.09 OPTIONS:

A. Thermal-magnetic breaker to provide a disconnect means as shown in the wiring diagrams on the drawings. Operating handle shall protrude from the door. The disconnect switch shall not be mounted on the door. The handle position shall indicate ON, OFF, and TRIPPED condition. The handle shall have provisions for padlocking in the OFF position with at least three (3) padlocks. Interlocks shall prevent unauthorized opening or closing of the VFD door with the disconnect handle in the ON position. This shall be defeatable by maintenance personnel.

B. Provide an input EMI filter to minimize conducted electrical noise to meet the requirements of IEC 61800-3.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install all equipment in accordance with drawings and specifications, manufacturer's recommendations, and applicable codes and regulations.

3.02 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

B. All final assemblies shall be tested at full load with application of line-to-line and line-to-ground bolted faults. The variable frequency drive shall trip electronically without device failure.

C. After all tests have been performed, each VFD shall undergo a burn-in test. The drive shall be burned in at 100% inductive or motor load without an unscheduled shutdown.

D. After the burn-in cycle is complete, each VFD shall be put through a motor load test before inspection and shipping.

E. The manufacturer shall provide three (3) certified copies of factory test reports.

3.03 FIELD QUALITY CONTROL

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component. Manuals shall be original factory-bound print. Photocopies are NOT allowed.

B. Provide the services of a qualified manufacturer's employed Factory Authorized Field Service Engineer to assist the Contractor in installation and start-up of the equipment specified under this section. Sales representatives will not be acceptable to perform this work. Scheduling and coordination of this service shall be by written request of the Construction Manager. The manufacturer's service representative shall provide technical direction and assistance to the Contractor in:
1. The general assembly of the equipment
2. Installation as specified in manufacturer's installation instructions
3. Wiring
4. Application dependent adjustments
5. Verification of proper VFD operation.

C. The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer's service representative:
1. Inspection and final adjustments
2. Operational and functional checks of VFDs and spare parts

D. The contractor shall certify that he has read the drive manufacturer's installation instructions and has installed the VFD in accordance with those instructions.

E. The Contractor shall provide three (3) copies of the manufacturer's field start-up report before final payment is made.

3.04 MANUFACTURER'S CERTIFICATION

A. A qualified factory-trained manufacturer's Field Service Engineer shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

3.05 MAINTENANCE / WARRANTY SERVICE

A. The manufacturer shall warranty the product for a period of 24 months from the date of start-up.

B. Warranty shall include all parts, labor and travel time.

3.06 TRAINING

A. The Contractor shall provide a training session for up to five (5) Owner's representatives for one (1) normal workday at the jobsite location determined by the Owner. Training and instruction time shall be in addition to that required for start-up service. Scheduling and coordination of this service shall be by written request of the Construction Manager.
   1. The training shall be conducted by the manufacturer's qualified Field Service Engineer.
   2. Instruction books, operation and maintenance manuals shall be provided to each participant in the training session. All instruction books, operation and maintenance manuals shall be original bound factory printed materials. Photocopies of such materials shall NOT be allowed

B. The training program shall consist of the following:
   1. An overview of operation and maintenance manuals.
   2. Instruction on the proper operation of the equipment.
   3. Instruction of the proper maintenance of the equipment.

C. Instructions on the proper operation of the equipment

END OF SECTION

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SECTION 26 43 13
SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provide surge protection devices for new service entrance equipment and secondary locations in the electrical distribution system at the as depicted and described in the contract documents.

1.02 DESCRIPTION

A. General: Surge protection device (SPD) is the description and equipment required for the protection of all AC electrical circuits and electronic equipment from the effects of lightning induced voltages, external switching transients and internally generated switching transients.

1.03 REFERENCE STANDARDS AND PUBLICATIONS

A. General: The latest edition of the following standards and publications shall comply to the work of this section:
1. ANSI/IEEE C84.1-1989, American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hertz)
2. ANSI/IEEE C62.41-1991, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
3. ANSI/IEEE C62.45-1992, IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits
4. Underwriters Laboratories UL 1449 Third Edition, Standard for Safety - Transient Voltage Surge Suppressors
5. Underwriters Laboratories, UL 1283, Standard for Safety - Electromagnetic Interference Filters
6. National Fire Protection Association, NFPA 780 - National Electrical Code
7. IEEE Standard 142-1991, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book)
8. ANSI/IEEE Standard 141-1999, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants (IEEE Red Book)
9. IEEE Standard 1100-1999, IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (IEEE Emerald Book)
10. FIPS Pub 94, Federal Information Processing Standards Publication - Guideline on Electrical Power for ADP Installations
11. National Electrical Manufacturer's Association LS-1, 1992 (NEMA LS-1)
12. MIL Standard 220A Method of Insertion-loss Measurement
13. ISO 9001:1994, Quality Systems - Model for Quality Assurance in Design, Development, Production, Installation and Servicing

1.04 QUALITY ASSURANCE

A. The manufacturer shall submit a written statement indicating that a factory authorized representative inspected the installation. The installing contractor shall submit a checkout memorandum to the manufacturer. The memorandum shall indicate the date the equipment is placed into service and the actual method of installation. Submit three copies to the specifying engineer.

B. The manufacturer must be regularly engaged in the manufacture of surge suppression products for the specified categories for no less than ten (10) years.

1.05 WARRANTY

A. The SPD and supporting components shall be guaranteed by the manufacturer to be free of defects in material and workmanship for a period of twenty years from the date of

substantial completion of service and activation of the system to which the suppressor is attached.

B. Warranty is to cover the effects of lightning, single phasing, and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.

C. The installation of SPDs in or on electrical distribution equipment shall in no way compromise the equipment listing, labeling, or warranty of the distribution equipment.

1.06 SUBMITTALS

A. Submit under provisions of Section 01 33 00 - Submittals.

B. The transient voltage surge suppression submittals shall include, but shall not be limited to, the following information:
1. Data for each suppressor type indicating conductor sizes, conductor types, and connection configuration and lead lengths.
2. Manufacturer's certified test data indicating the ability of the product to meet or exceed requirements of this specification.
3. Drawings with dimensions indicating SPD mounting arrangement and lead length configuration and mounting arrangement of any optional remote diagnostic equipment and assemblies.
4. List and detail all protection systems such as fuses, disconnecting means and protective materials.
5. SPD wiring, bonding, and grounding connections shall be indicated on the wiring diagrams for each system. Include installation details demonstrating mechanical and electrical connections to equipment to be protected.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Surge Protection Devices shall be a Joslyn - Total Power Solutions ServiceTrack ST Series device or approved equal. Manufacturers requesting product approval must meet the written specification contained herein.

2.02 GENERAL REQUIREMENTS:

A. SPDs shall be listed in accordance with UL 1449 3rd Edition, Type 1 for Type 1 and Type 2 locations and UL 1283, Standard for Safety, Electromagnetic Interference Filters.

B. The SPD shall protect all modes and there shall be seven discrete suppression circuits: 3 modes connected Line to Ground, 3 modes connected Line to Neutral, and 1 mode connected Neutral to Ground for a 3-phase, 4-wire, plus ground voltage system. Line to Neutral to Ground is not an acceptable substitute for Line to Ground. Line to Neutral to Line and Line to Ground to Line (in combination) will be acceptable for Line to Line protection.

C. All SPDs must have passed the UL 1449 3rd Edition Fault Current Test with a Rating of 200,000 AIC. Documentation substantiating this claim must be provided.

D. SPDs shall use a separate path to building ground; the equipment safety ground is not to be used as a transient ground path.

E. All SPDs are to be MOV based and not included SAD technology as a means of suppression.

F. The maximum continuous operating voltage (MCOV) of all components shall not be less than 125% for a 120V system and 115% for 220, 240, 277, and 480V systems.

G. Standard diagnostic features are to include green LEDs (one per phase - normally on) indicating power and suppression status and a form C dry relay contact.

H. Extended diagnostics must include an audible alarm and surge counter to be displayed on an LCD display on the front of the suppressor. The surge counter must include a reset option. The audible alarm must include a mute option. Products requiring diagnostic test kits will not be acceptable.

I. SPDs shall be of compact design. The mounting position of the SPD shall allow a straight and short lead-length connection between the SPD and the point of connection in the panelboard.

J. Visual indication of proper SPD connection and operation shall be easily viewed on the front panel of the enclosure. The indicator lights shall indicate suppression circuit status, phase status, phase loss, reduced protection level and suppression fault.

K. Where not provided with a dedicated overcurrent protection and disconnect means in the equipment it is protecting, the SPD shall be equipped with such integrally to its enclosure.

L. A set of normally open/normally closed Form "C" dry contacts shall be provided for remote monitoring.

M. The enclosure type shall have a minimum of a NEMA 1 rating when mounted internal or external to the power distribution equipment if located indoors. Provide a NEMA 4 enclosure for all outdoor mounted locations.

N. SPDs shall have a diagnostics LCD panel display providing information on phase loss (specific to each phase), surge/transient event count, stored cumulative surge/transient event history, and technical support information.

O. SPDs shall be equipped with an audible alarm with mute, reset and acknowledge features.

P. The device must be certified (report to be submitted) to withstand a minimum of 20,000 Category C3 (Combination wave - 20,000 Volts - 1.2x50 :s OCV and 10,000 Amps - 8x20 :s SCC as defined by ANSI/IEEE C62.41-1991) impulses with less than 10% change in the baseline to final let-through voltage. This data must be submitted as an independently verified and certified test report.

Q. Unit shall have component level fusing integral to the SPD for over current protection.

R. The maximum value for the attenuation for the suppressor must exceed a minimum of 33 dB. All measurements for this requirement must be taken using the MIL STD 220A method and with only six (6) inches of lead length extending outside of the normal exit location of leads for the enclosure.

2.03 PROTECTION REQUIREMENTS:

A. SPD shall provide protection for all modes of protection (L-L, L-N, L-G & N-G).

B. Response time of SPD to a surge shall be less than one nanosecond.

C. Maximum rated surge current: 160 kA per phase / 80 kA per mode.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The installing contractor shall install the parallel SPD with short and straight conductors as practically possible.

B. The contractor shall follow the SPD manufacturer's recommended installation practice as found in the equipment installation instructions.

C. The installation shall meet the requirements of all applicable codes.

END OF SECTION

SECTION 26 51 00
LIGHTING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The work of this section includes interior, exterior lighting, and lighting inverter.

1.02 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Provide product data for lighting units including outline and mounting dimensions, ballast performance data, lighting efficiency tables, and graphic representation of photometric light distribution for each fixture or lighting unit.

C. Provide product data for lighting inverter.

1.03 WARRANTY:

A. All light fixtures or lighting units shall be fully warranted against defective workmanship and materials for a period of one year from date of substantial completion.

1.04 QUALITY ASSURANCE:

A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

B. UL Compliance: Emergency lighting fixtures shall be UL listed and labeled.

C. Local Code Compliance: Comply with applicable local codes and regulations for emergency lighting and exit signage including, but not limited to, colors and letter heights for exit signs.

D. UL Standard 8750 "Light Emitting Diode Equipment for Use in Lighting Products", IES Standard LM-79 "Electrical and Photometric Measurements of Solid-State Lighting Products", IES Standard LM-80 "Measuring Lumen Maintenance of LED Light Sources", and IES Standard TM-21 "Projecting Long Term Lumen Maintenance of LED Light Sources".

E. ANSI C78.377 "Specifications for the Chromaticity of Solid State Lighting Products" with LEDs binned within a maximum three-step MacAdam Ellipse to ensure color consistency amongst luminaries of the same type

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Acceptable manufacturers are as specified in the fixture schedule.

2.02 INTERIOR & EXTERIOR BUILDING LIGHTING:

A. Provide only LED fixtures with a Design Lights Consortium (DLC) listing, a U.S. Department of Energy (DOE) "LED Lighting Facts" label, or a U.S. Environmental Protection Agency (EPA) ENERGY STAR label, which have demonstrated third-party testing verification.

B. LED based interior building lighting units shall be equipped with drivers and other components as required to provide to provide a complete lighting unit. LED fixtures shall

be modular and allow for separate replacement of LEDs and their drivers. User serviceable LED units and drivers shall be replaceable from the room side.

C. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 "Electronic Drivers for LED Devices, Arrays, or Systems". LED drivers shall have a sound rating of "A", have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.

D. Electronic driver for the LEDs shall be integral with luminaire rated for the corresponding circuit voltage as noted on the schedule. Driver shall be capable of powering the LED wattage output as specified with a power factor above 90%. Driver shall have an interrupting rating of 10,000 amps minimum per ANSI/IEEE C62.41.2

E. Dimmable LED fixtures shall have either a 0-10 volt, 3-wire dimming driver, or a two-step (50%-100%) line voltage, two switch controlled dimming driver, as shown on the drawings

F. Provide fixtures as shown on the drawings and listed in Fixture Schedule. The work shall include all labor, materials, canopies, suspension of proper length, sockets, holders, reflectors, ballasts, diffusing materials, louvers, plaster frames, recessing boxes, etc., for the proper installation of the fixture. Provide adequate supporting facilities for lighting system as specified or shown on drawings.

G. LEDs shall have a lamp temperature rating of 4000°K unless otherwise noted on the lighting fixture schedule. LEDs shall have a lumen maintenance L70 rating of 50,000 hours minimum

H. Refer to the drawings for the fixture schedule, mounting type and heights, lamp type and quantities.

2.03 LIGHTING INVERTER SYSTEMS:

A. Scope: Inverter System shall be furnished to provide a reliable source of power and shall operate during a utility line disturbance without any interruptions of power supplied to the load. The transfer from utility power to battery power shall utilize a true no break system, pulse width modulated sine wave output to prevent sensitive loads from "winking out." The system shall be capable of powering any combination of electronic, power factor corrected, fluorescent, incandescent or HID lighting; building management system, security system and any other critical voltage or frequency-sensitive electronic loads. The system shall operate from 0-100% loading and be rated to deliver its full KVA/KW rating, at unity power factor, for a minimum of 90 minutes. Upon return of the normal AC utility line power, the system shall return to standby mode automatically and without any interruption of power supplied to the load. The charging system shall recharge the batteries within 24 hours.

B. Codes and Standards: Inverter System shall be listed to meet these standards. Applicable codes and standards include:
   1. UL 924 Standard for emergency Lighting and Power Equipment
   2. Complies with NEC, OSHA and Life Safety Code

C. The Inverter System shall be an Illuminator Series Emergency Lighting Inverter System manufactured by Myers Emergency Power Systems or an approved equal. Contractor shall verify exact physical space available for wall mounting to confirm space availability before submitting an alternate equal for approval.

D. Furnish and install an inverter system that will supply a minimum of 350 VA @ unity power factor, for a period of 1.5 hours upon interruption, brownout, or failure of the monitored AC utility line.

E. Operation:
1. The system's operation shall be fully automatic and utilize a linear transformer. The inverter shall be of the Pulse Width Modulated (PWM) design and shall provide true "no break" power to the load at all times.
2. During normal operation, the charger maintains the battery bank at full capacity. The on-board microprocessors continuously monitor charger settings and system's overall readiness. The system's circuitry shall also include an automatic, multi-rate, software-controlled charger able to recharge batteries per UL924 guidelines.
3. The inverter section shall be off-line during standby operation to increase overall efficiency up to 98%. Continuously running double conversion systems shall not be permitted.
4. The automatic overload circuit protection shall shut down the system at 115% of its rated capacity, regardless of whether it is in normal and emergency operations. The system protection shall also include a low battery voltage disconnect, AC input circuit breaker, a DC input fuse and switch, and an AC output fuse. A single pole 20 amp output circuit breaker shall be supplied on all models as standard equipment. The system shall supply a digitally generated sinusoidal output waveform with less than 5% total harmonic distortion at rated linear load.

F. Input Voltage: The available input voltage to the systems shall be 120 or 277, +/-10%, single phase, with a frequency of 60Hz. Refer to drawings for correct voltage.

G. Output Voltage: The available output voltage of the system shall be the same as the input voltage, 120 or 277 volts, +10%/- 5% single phase sine wave, with a frequency of 60Hz +0.05Hz on inverter. The output voltage and frequency, when on utility power, shall be as supplied by the utility. Refer to panelboard schedules for correct voltage.

H. System Diagnostics: System shall be supplied with intelligent multipurpose LED indicators to notify the user as to system changes or possible problems. The LED illumination pattern can be interpreted as to the system's condition; these include:
1. AC input failure
2. Charger failure
3. No load connected
4. Overload shutdown
5. Inverter on
6. Heat sink over temperature shutdown
7. Temperature probe failure
8. Circuit breaker tripped

I. Alarms: An audible alarm shall be provided for all alarm and shutdown conditions.

J. Manual Testing: The system shall incorporate a push to test switch to initiate an inverter test at any time. During this test, a power failure will be simulated and the batteries shall power the connected load through the inverter.

K. Battery Charger: The charger shall be software controlled, temperature compensated, and three-step float type charger, with equalizer. The charger shall maintain the batteries fully charged during normal standby condition. Following a power failure the charger will start in constant current mode until battery voltage reaches an equalized state. Equalized voltage will then be maintained until charging current drops to .5 amps or .3% of the battery amp/hour rating; battery voltage will then be allowed to drop down to Float.

L. Batteries: The batteries will provide sufficient power to maintain the output voltage of the inverter for a period of 1.5 hours, without dropping below 87.5% of nominal battery voltage. The batteries shall be Sealed Lead Calcium VRLA type, enclosed in a cabinet that permits easy maintenance without requiring removal. Batteries shall require no addition of water over the life of the battery. The case and cover shall be constructed of polypropylene, contain low-pressure safety release vents, and be non-gassing in normal use. Batteries shall have a10-year design life expectancy at 77°F (25°C).

M. The following factory installed optional equipment shall be furnished with inverter systems rated 300VA to 1,000VA:
1. Output Circuit Breakers with Alarms.
2. Normally Off Output Breaker.

N. Mechanical: The system shall be contained in a code gauge, NEMA 1 steel cabinet with conduit knockouts at the top with front access. Cabinets for the 525 VA size and under shall be designed for wall mounting, all others will be floor mounted, unless noted otherwise. Manufacturer will supply all necessary brackets. All components must be front accessible. All inverter components shall have a modular design to facilitate field service. Mean Time To Repair shall be 30 minutes or less.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install interior and exterior building lighting units in accordance with NEC, local codes, manufacturer's recommendations, and other applicable standards and practices to provide a high quality installation.

B. Support fixture directly from building structure, by rod hangers and inserts or metal formed channels supported from framing structure at ceiling suspension system. Do not support fixtures directly from ceiling grid unless listed for grid mounting.

C. In placing outlets, fixtures (surface mounted, recessed, and semi-recessed) maintain alignment, spacing, layout, and general arrangements as shown on the drawings.

D. Minor variations from drawing dimensions may be made to clear construction interferences or other mechanical obstructions. Final arrangements shall present a symmetrical appearance, as approved by the Engineer.

E. Emergency egress lighting shall be provided by using normally operated lighting loads equipped with a UL924 emergency lighting relay control unit. See drawings for manufacturer and part number or relay.

END OF SECTION

SECTION 27 20 00
DATA COMMUNICATIONS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK:

A. Establish Ethernet communication between the new Headworks Facility control system (HCP), Treatment Facility control system (TCP) and the existing SCADA system located in the Biopure Wastewater Treatment Facility Control Room/Office via fiber optic connection points in the Irrigation Pump Station control system (ICP) and Wastewater Treatment Facility control system (MCP). Refer to SCADA riser diagram and site plan for proposed work.

B. Communication systems include Category 6 Ethernet cabling, multimode fiber optic, and radio transmission equipment.

C. Extent of work shall include but not limited to the following:
1. Communication equipment will be mounted in PLC control panels.
2. Ethernet media converters & switches, and Category 6 (Cat 6) UTP cabling.
3. Fiber optic cabling, patch panels and fiber terminations
4. Startup and commissioning of communication system.
5. Radio communication equipment is specified in section 40 95 10.

1.02 RELATED SECTIONS:

A. Section 26 05 00 - Electrical General Provisions

B. Section 26 05 33 - Conduit

C. Section 26 05 34 - Electrical Boxes

D. Section 40 95 10 - Lift Station Control Panels

1.03 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Itemized Listings:
1. Description of deviations from the requirements of this section.
2. Re-submittals shall contain response(s) to each comment made by Engineer.

C. Shop drawing submittal material shall be project specific.

PART 2 – PRODUCTS

2.01 DATA INFRASTRUCTURE WIRING:

A. Unshielded Twisted Pair (UTP) Cabling For Voice/Data.
1. UL verified to Category 6 and rated for minimum 1000MB/sec.
2. Paired, 4 pair, 23 AWG, solid bare copper conductors with polypropylene insulation PVC jacket. Outer jacket shall be blue.
3. Manufacturer: Belden 2413A; or equal.
4. Provide plenum rated cable where installed exposed.
5. For outside plant installations, cables shall be rated for installation in outdoor applications where exposed to the elements. Cables shall have waterblock tape and be suitable for direct burial.

B. UTP Patch Cables:

1. Available with RJ-45 style connectors, coordinate lengths with installation requirements.
2. Connectors shall be factory installed, with snagless molded strain relief.
3. Minimum rating Category 6 in accordance with TIA/EIA-568.
4. Field assembled terminations will not be acceptable.

C. Voice/Data cable jacketing (entire length) shall be color coded as follows:
1. SCADA - Yellow
2. Voice/Telephony - Green
3. Office Network - Blue

D. Modular jacks shall be color coded as follows:
1. RJ-45 (Data) - Match cable jacket color.
2. RJ-11 (Voice) - White

E. Cover plates shall be Office White/ Dusty White (non-metallic).

F. Acceptable Manufacturers for cover plates and modular jacks: Hubbell, Avaya or approved equal.

2.02 FIBER OPTIC PATCH CABLES:

A. Available with SC or LC style connectors, coordinate with equipment provided. Coordinate lengths with installation requirements.

B. 125 microns cladding diameter with minimum bending radius of 2 inches or less.

C. Fiber optic patch cable outer jacket shall be PVC, colored yellow (single mode), orange (multimode) unless otherwise noted.

D. Connectors shall be colored blue (single mode), beige (multimode) and shall be further color coordinated to identify Tx and Rx.

E. Manufacturers: Leviton, Panduit; or Engineer approved equal.

2.03 FIBER OPTIC CABLE:

A. Outdoor Fiber Cabling (SCADA):
1. Multiple strand (12 strand or as noted) tight buffer multimode fiber cable. Cable shall be rated for indoor/outdoor use. UV resistant jacket. Gel filled buffer tubes are not acceptable.
2. 50/125µm or 62.5/125.
3. Optical operating wavelength: 1310nm, with a maximum tight buffer attenuation of 0.8/0.5 dB/km.
4. Data transmission rate of 1 Gigabyte per standard compliance of TIA/EIA-568-B.3.
5. SC or LC style terminations based on equipment requirements.
6. Minimum Bend Radius:
   a. Installation: 3.4 inches.
   b. Operating: 2.4 inches.
   c. Coordinate bend radius with proposed or exixting raceway dimensions, provide appropriate cable or modify raceway as required.

B. Cable shall be installed in underground duct and be rated for below grade applications.

C. Acceptable manufacturers: Optical Cable Corporation (OCC), Laser Ultra-Fox; Belden; or approved equal.

2.04 FIBER OPTIC PATCH CONNECTION PANELS:

A. Modular style panels shall have a minimum of six (6) fiber connection points. Unit shall be equipped with an inner drawer which allows for the fiber connectors to be protected on both the incoming and outgoing termination sides. Patch termination shall be compatible with selected fiber terminations (ST/SC/LC).

B. Outlet/jack shall be colored blue (single mode), beige (multimode).

C. Housing:
1. Rack-mount style patch panels for use with rack mounted equipment.
2. Wall-mounted style, steel, patch panels for use in control panels and other enclosures.

D. Each patch point shall have a unique label and directory shall be permanently affixed inside enclosure.

E. Acceptable Manufacturers: Seicor, Corning, Commscope, Systimax, or equal.

2.05 UNMANAGED INDUSTRIAL-GRADE ETHERNET SWITCHES:

Unmanaged Ethernet switches shall be provided with the 5-port configuration.

A. Unmanaged Ethernet switch shall have the following specifications:
1. 10/100BaseTX, autosensing, duplex RJ-45 ports, Fast Ethernet ports
2. Rugged industrial enclosure, DIN-rail mountable
3. Vibration, shock and humidity ratings shall be suitable for industrial use
4. 0°C to 60°C (32°F to 140°F) operating temperature range
5. 10-30 VDC nominal input voltage.
6. Manufacturer: Hirschmann, Moxa, Allen Bradley, or Cisco

2.06 UNMANAGED INDUSTRIAL-GRADE ETHERNET/FIBER OPTIC MEDIA CONVERTER:

A. Unmanaged media converter shall be provided with (1) TX and (1) FX port configuration.

B. Unmanaged media converter shall have the following specifications:
1. 10/100BaseTX, autosensing, duplex RJ-45 ports, Fast Ethernet ports
2. 100Base FX, MM, SC socket
3. Rugged industrial enclosure, DIN-rail mountable
4. Vibration, shock and humidity ratings shall be suitable for industrial use
5. 0°C to 60°C (32°F to 140°F) operating temperature range
6. 10-30 VDC nominal input voltage.
7. Manufacturer: Hirschmann, Moxa, Allen Bradley, or Cisco

PART 3 – EXECUTION

3.01 EXAMINATION:

A. Examine areas and conditions under which voice/data systems are to be installed. Notify Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the Construction Manager.

3.02 INSTALLATION OF RACEWAY:

A. Provide conduit properly sized for all data and telephone cabling located in spaces where the cabling is surfaced mounted or exposed.

B. All UTP cables that enter or leave an enclosure and connect to a data jack/wall outlet shall be terminated at a patch panel.

C. Patch panels shall have 200% spare capacity.

D. Rack mount patch panels shall utilize horizontal and vertical cable management components.

E. Network cables and patch cables shall not block or hang in front of equipment or patch panels.

F. Standalone patch panels shall have hinged mounting brackets.

G. Provide patch cables for all patch panel points, including spare.

H. All cabling shall be installed and tested per the TIA/EIA 568A - Commercial Building Telecommunications Cabling Standard.

END OF SECTION

EARTHWORK

DIVISION 31

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SECTION 31 23 00
SITE GRADING, EXCAVATION, AND BACKFILL

PART 1 - GENERAL

1.01 SUMMARY

A. The work covered by this section consists furnishing all supervision, labor, materials, and equipment necessary for site grading including stripping of topsoil, excavation, trenching and backfilling for utilities, shaping of earth to match proposed grades in the Drawings, and backfilling proposed structures.

B. Earthwork requirements include, but are not limited to, berm construction with compacted clay, construction and replacement of gravel access drives, and trenching, excavation, and backfill of piping and structures.

C. Refer to the general specifications provided in Appendix A that are hereby made a part of this contract: “Specifications for Excavating, Trenching, and Backfilling for Utilities”, and “Specifications for Surface Restoration”.

D. Refer to Section 01 57 13 – “Temporary Erosion and Sediment Control” for Soil Erosion and Sedimentation control requirements.

1.02 REGULATIONS AND STANDARDS

A. All work shall conform to relevant requirements of the State of Michigan Soil Erosion and Sedimentation Part 91, Act 451 of the Public Acts of 1994, as amended.

B. Compaction: Density of fill material shall be compared to maximum density as determined by the ASTM D-1557 (Modified Proctor Method).

C. Datum Elevation: Elevations as shown on the site plan and all elevations for the work shall be referenced to NAVD 1988. The General Contractor shall be held responsible for the correct elevation of the work.

1.03 SUBMITTALS

A. If requested by the Engineer, provide verification from an approved laboratory that all MDOT Class II granular material and MDOT 22A aggregate meets MDOT requirements.

B. Submit results of sieve and hydrometer analysis and Atterberg Limits on the imported clay material prior to placement of clay.

1.04 QUALITY ASSURANCE

A. The Contractor shall provide compaction testing for fill soils and aggregate. The Contractor shall pay for additional tests if the results show the material to be under the specified percentage of maximum density. Compaction testing for fill soils and aggregate shall be provided once per day during site work.

B. Density and moisture testing of clay placed for berm construction shall be completed at a minimum of once per 1,000 cubic yards. Results of all testing shall be provided to the Engineer within 48 hours of testing. The following tests shall be performed at the responsibility of the Contractor:
   1. Compaction, by Modified Proctor Test ASTM D1557.
   2. Natural Moisture Content.

C. The following tests shall be completed at a minimum twice per constructed berm. Testing shall be the responsibility of the Contractor. Results of all testing shall be provided to the Engineer within 48 hours of testing:
   1. Grain Size ASTM D422.
   2. Atterberg Limits ASTM D4318.
   3. Permeability, by collection of Shelby Tube ASTM D5856.

1.05 JOB CONDITIONS

A. Several soil borings have been completed and are shown on the Drawings. Structural slabs and footings have been sized by the Engineer on the basis of the soil boring data for a bearing capacity of 3,000 pounds per square foot. Should the Contractor encounter any unusual conditions during excavation operations, he shall advise the Engineer and call for an inspection.

B. Ground contours have been provided in the Drawings for reference only. Bidders shall be expected to have inspected the Site and satisfied themselves as to actual grades and levels and conditions under which the work is to be performed.

C. Benchmarks provided for elevation reference shall be preserved. If replacement of benchmark is necessary, it will be at the Contractor's expense.

D. Utilities: Existing utilities as shown on the Drawings are for reference only. The Contractor shall be responsible for hand digging as necessary to properly locate all existing utilities prior to excavating and shall be responsible for replacement of any damaged utility at no additional cost.

1.06 ALLOWANCE

A. Provide in the base bid an allowance of $15,000 for re-routing or abandonment activities that may need to occur due to encountering unexpected utilities (not shown on the Drawings or flagged prior to construction) during the course of excavation work on the site. Submit an itemized cost breakdown to the Engineer for approval for any item to be charged to this allowance. Contract amount shall be adjusted to reflect actual cost. See Section 01 21 00 – "Allowances" for further information.

PART 2 - PRODUCTS

A. Fill: All fill material brought on site and fill placed around structure walls and/or as pipe/trench fill shall be controlled fill meeting requirements of MDOT Class II granular material. The fill shall be placed in even layers not exceeding nine inches in depth and shall be thoroughly compacted to 95% of maximum density as determined by the Modified Proctor Method.

B. Aggregate: Aggregate for gravel road/drive area shall be as shown on the Drawings. Aggregate for HMA base shall be as shown on the Drawings.

C. Clay Fill/Compacted Clay: Compacted clay for use in construction of berms shall have a unified soil classification of ML, SC, CL, or CH as determined by ASTM D2487-69. The compacted clay material shall have a permeability not exceeding 10^{-7} cm/sec. Permeability shall be verified with field testing per 1.04.C above.

PART 3 - EXECUTION

3.01 PREPARATION

A. Topsoil:

   1. Remove from all areas of new construction and stockpile on site.

2. If quantity of stockpiled topsoil is insufficient, provide additional topsoil as required to complete landscape work.

B. Aggregate Drive/Road:
1. Remove aggregate from all drive/road areas to be disturbed during construction.

C. Utilities:
1. Before starting excavation establish location and extent of underground utilities occurring in work area.
2. Notify utility companies to remove and relocate lines which are in conflict with design locations.

3.02 EXCAVATION

A. Excavate as required for construction of the work. Utilize or dispose of excavated materials as required.
1. Protect excavation and adjacent structures by shoring, bracing, sheet piling or other methods as required.
2. Remove unsuitable material to firm underlying soils beneath footings, floor slabs, paved areas and walks.

B. Preparation of Subgrade:
1. Compact granular material under footings, slabs, pavement and walks to 95% maximum density unless otherwise specified. Contractor shall verify bearing capacity meets 3,000 pounds per square foot.

C. Utilities:
1. Comply with requirements of "Specifications for Excavating, Trenching, and Backfilling for Utilities" included in Appendix A.
2. Maintain, reroute or extend as required, existing utility lines to remain which pass through excavation area.
3. Protect utility services uncovered by excavation.
4. Cap off, plug or seal, discontinued utility services and remove from site within excavated areas.

3.03 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
1. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing:
1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition as required to carry out the Work.
2. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
3. Extend shoring and bracing as excavation progresses.

3.04 ROUGH GRADING

A. Rough grade to levels, profiles, contours and elevations required for finished grades and surface treatment.

B. Maintain the following, rough grades unless otherwise directed by Engineer:
   1. Sidewalk: 4 inches below finished grade.
   2. Floor Slabs and Exterior Slabs: 6 inches below bottom slab elevation.
   3. Pavement Surfaces: As shown.
   4. Landscape Areas: 4 inches below finished grades to receive topsoil.

3.05 PLACEMENT AND COMPACTION

A. Place backfill and fill materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand operated tampers.

B. Under Floor Slabs and Exterior Slabs: MDOT Class II granular material placed in layers maximum 12 inches deep compacted to 95% maximum density.

C. Under aggregate base for Roadways and Driveway: MDOT Class II granular material placed in layers maximum 12 inches deep compacted to 95% maximum density.

D. Under Foundations: MDOT Class II granular material placed in layers maximum 12 inches deep compacted to 95% maximum density.

E. Cast-in-place concrete foundation walls or retaining walls shall not have backfill placed until seven (7) days after completion of walls.
   1. Do not operate heavy equipment for spreading or compacting closer to foundation walls or retaining walls than a distance equal to the height of fill or backfill above the top of footing.
   2. Bring up backfill as far as practicable evenly on each side of wall and sloped to drain away from the wall.
   3. Where fill or backfill is to be placed and compacted against walls, support walls laterally as necessary to prevent damaging or displacing the walls.
   4. Replace walls that are damaged or displaced as a result of Contractor's operations at the Contractor's expense.

F. Clay - Compact in in layers not exceeding 6" to a minimum of 90% of the maximum density established by the modified Proctor test ASTM -D1557 at a moisture content between 2% less than and 5% more than the optimum moisture content. Where placed clay berm fill is tied into existing clay berms, the existing berm shall be scarified before compacting together in order to achieve cohesive compaction.

G. Surfacing Aggregate and Aggregate Base for hot mix asphalt pavement: MDOT 22A placed in layers not to exceed eight (8) inches compacted to 98% of its maximum unit weight in accordance with MDOT procedures.

H. Landscaped Areas: Suitable excavated material or granular material placed in layers maximum 12 inches deep compacted to 90% maximum density.

I. Properly place and compact all required materials and exert proper control over the moisture content of the material and other details necessary to obtain satisfactory results.
   1. Remove materials that cannot be compacted with manipulation and/or moisture control.
   2. Replace with suitable excavated materials or granular materials at no cost to the Owner.

J. Correct any deficiencies resulting from insufficient or improper compaction. Retest if required.

3.06 GRADING

A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas.

B. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

C. Grading Outside Building Lines:
   1. Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
   2. Finish surfaces free from irregular surface changes.

D. Grading Surface of Fill under Building Slabs:
   1. Grade smooth and even, free of voids, compacted as specified, and to required elevation.
   2. Provide final grades within tolerance of 1/2 inch when tested with 10 foot straightedge.

3.07 SURPLUS MATERIALS

A. Surplus excavated or unsuitable excavated material becomes the property of the Contractor.

B. Dispose of surplus or unsuitable excavated materials off site.

3.08 DUST CONTROL

A. Dust Control Measures:
   1. Maintain dust control so as not to cause detriment to the safety, health, welfare, or comfort of any person or cause damage to property or business.
   2. Perform at no additional cost to the Owner.

3.09 RESTORATION

A. Disturbed Berm Access Drives: Contractor shall restore existing access drives disturbed during construction. Access drive shall match existing grades where disturbed and shall consist of 6 inches of MDOT 22A compacted in place to 98% of modified proctor.

END OF SECTION

[Intentionally left blank]

PART 1 - GENERAL

1.01 SUMMARY

A. The work covered by this section consists of furnishing all supervision, labor, materials, and equipment necessary for dewatering excavations required as part of the project.

1.02 JOB CONDITIONS

A. When dewatering of groundwater is required, the Contractor shall limit the dewatering operation to the minimum time and depth required for construction. The Contractor shall submit to the Engineer, Owner and Oceana County Road Commission a dewatering plan indicating how dewatering will be accomplished, along with how and where dewatering discharge will be directed and controlled. Dewatering flows shall not be directed immediately to any watercourse. All flow shall be directed to an "ecolobag" or Engineer approved equal sediment trap. The sediment trap shall be located to allow a minimum overland flow 100 feet prior to entering any water course.

PART 2 - PRODUCTS

*** Not Used ***

PART 3 - EXECUTION

See "Specifications for Excavating, Trenching & Backfilling for Utilities" in Appendix B, which are hereby make part of this specification.

END OF SECTION

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SECTION 31 23 23
FLOWABLE FILL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes flowable fill, also described as controlled low-strength material (CLSM), or controlled density fill. Flowable fill shall be used for abandonment of existing piping as indicated in the Drawings.

1.02 REFERENCES

A. American Concrete Institute (ACI):
1. ACI 229R, "Controlled Low-Strength Materials"

B. American Society for Testing and Materials (ASTM): Latest edition for each specified throughout.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Design Mixtures: For each flowable fill mixture. Mix design shall produce a consistency that results in a flowable product which is non-segregating and does not require consolidation. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Flowable fill shall be manufactured by a firm experienced in manufacturing ready-mixed concrete products and with a minimum of 5 years experience in the production of similar materials.

B. Materials: Materials shall comply with the recommendations of ACI 229R.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I, or II.
2. Fly Ash: ASTM C 618, Class C.

B. Normal-Weight Aggregates: ASTM C 33, aggregates shall be provided from a single source.
1. Coarse Aggregate shall have a maximum aggregate size of 3/8-inch.
2. Fine Aggregate shall be concrete sand. No more than 12 percent of fine aggregate shall pass the No. 200 sieve and no plastic fines shall be present.
3. Combined aggregate shall be graded to produce flowable fill that has optimum flow and consolidation characteristics.

C. Water: ASTM C 94; potable.

2.02 MIXTURE

A. Flowable Fill: Proportion flowable fill mixture to meet the following requirements:
1. Compressive Strength: Minimum 150 psi, maximum 200 psi at 28 days.
2. Slump Limit (Flowability): As required for Contractor's methods, but shall not promote segregation and shall be 9 inches maximum.
3. Shrinkage: Flowable fill shall have minimal bleed water shrinkage.

4. Mix Design: The flowable fill mix design shall be proportioned such that the final product meets the strength, flow consistency, and other requirements of this specification.

PART 3 - EXECUTION

3.01 PLACEMENT

A. Place flowable fill by any method which preserves the flowability, density, and compressive strength.

1. Each placement of flowable fill shall be as continuous as possible.

2. Flowable fill shall be protected from freezing for at least 24 hours after placement. The ambient temperature shall be 35 degrees and rising at the time of placement.

3. Protect exposed surfaces of flowable fill from premature drying.

3.02 FIELD QUALITY CONTROL

A. Testing: Contractor shall engage a qualified testing agency to perform field tests and prepare test reports. All testing costs shall be part of the Contractor's bid. All test reports shall be provided by the testing agency to the Owner and Engineer.

B. Tests: Sampling and testing of flowable fill shall conform to ASTM D 5971 and shall be performed according to the following requirements:
1. Testing Frequency: ASTM D 4832; Obtain one composite sample, four specimens, for each day's pour of each flowable fill mixture.
2. Slump: ASTM D 6103; One test at point of placement for each composite sample, but not less than one test for each day's placement of flowable fill.
3. Temperature: Perform one test for each composite sample.
4. Compressive-Strength Tests: ASTM D 4832; Test one laboratory-cured specimen at 7 days and one set of two laboratory cured specimens at 28 days.

END OF SECTION

SECTION 31 35 00
SLOPE PROTECTION

PART 1 - GENERAL

1.01 SCOPE:

A. Work includes all labor and materials required to provide slope protection on the lagoon and pond berm side slopes per the Contract Drawings.

B. All materials and work shall be in accordance with Sections 813, 910 and 916 of the Michigan Department of Transportation (MDOT) 2020 Standard Specifications for Construction.

1.02 REFERENCES:

A. Michigan Department of Transportation (MDOT), "2020 Standard Specifications for Construction"

B. American Society for Testing and Materials (ASTM), latest edition.

1.03 SUBMITTALS:

A. Submit all materials under provisions of Section 01 33 00.

PART 2 - PRODUCTS

2.01 GENERAL:

A. All materials shall be in accordance with MDOT 916 and installed in accordance with MDOT 813 specification for slope protection.

B. Berm side slope protection shall be limestone, 4-8 inches diameter, placed in a layer with a thickness of no less than 8 inches. Crushed concrete will not be acceptable.

C. Slope protection on the west side of the proposed Headworks building shall be MDOT Rip Rap, Heavy, placed in one layer.

D. Slope protection on the northwest side of the proposed Headworks building west retaining wall shall be MDOT Rip Rap, Plain, placed in one layer.

E. Stone shall be placed over non woven geotextile fabric in accordance with MDOT 910.

PART 3 – EXECUTION

A. General: Per Michigan Department of Transportation (MDOT) 2020 Standard Specifications for Construction.

END OF SECTION

[Intentionally left blank]

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes members to be used in the construction of steel sheet pile. This Specification covers the installation of permanent steel sheet piling and installation, maintenance, and removal of temporary steel sheet piling, or cutting off temporary steel sheet piling left in place, including bracing, tie backs, walers, and related material.

1.02 RELATED SECTIONS

A. SECTION 02 22 13 – "Movement and Vibration Assessment and Monitoring"

1.03 REFERENCES

A. American Welding Society (AWS):

B. AWS D1.1, "Structural Welding Code – Steel"

C. American Society for Testing and Materials (ASTM): Latest edition for each specified throughout.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Contractor shall provide qualifications of the proposed sheet pile installer.

C. Contractor shall provide manufacturer certification that indicates the sheet piling meets or exceeds the requirements of this Specification.

D. Contractor shall submit verification that the hammer can deliver the required energy.

E. Contractor shall submit engineered design calculations for the steel sheet piles intended for use on the project prepared by a Professional Engineer, registered in the State of Michigan.

F. Contractor shall submit shop drawings and specifications for the steel sheet piles intended for use on the project that include; pile profiles, product components and accessories, planned installation depth, minimum installation depth, and sheet pile layout.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Sheet piling installer shall have, as a minimum, 5 years experience in the installation of sheet piling of comparable overall lengths and sections into soils similar to those found on the Project.

PART 2 - PRODUCTS

2.01 GENERAL

A. All permanent steel sheet piling shall be new and unspliced material, unless otherwise reviewed and accepted by the Engineer. Temporary sheet piling shall be new or used in good condition.

B. Steel sheet piles and special fabricated shapes shall be designed to ensure continuous interlock along the entire length when in place, including connections and corner pieces.

2.02 MATERIALS

A. Steel sheet piling shall meet the requirements of ASTM A328 minimum.

B. Steel corners, tees, wyes and crosses shall meet the requirements of ASTM A328 or ASTM A690.

C. Steel sheet piles and interlocks shall not have excessive kinks, camber or twist that would prevent the pile from reasonably free sliding.

D. All fabricated connections shall be made with the use of angles or bent plates, as necessary, and shall be adequately welded or connected with high strength bolts.

E. Handling Holes:
1. If handling holes are provided they shall be plugged by welding a piece of steel over the hole prior to installing any riprap, backfill, or cap, and shall be watertight.

2.03 STORAGE AND HANDLING

A. Do not subject piles to damage in transporting to, and storing piles onsite.

B. Store and handle piles such that any protective coating will not be damaged.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General
1. All welding or gas cutting shall be in accordance with the current standards of the American Welding Society.
2. Steel sheet piling shall be driven to the depths shown on the submittals.

B. Sheet Pile Driving
1. Steel sheet piling shall be assembled before driving and then driven as a continuous wall, progressively in stages to keep the piles aligned correctly and minimize the danger of breaking the interlock between sheets.
2. Steel sheet piling shall be driven to form a tight bulkhead.
3. A driving head shall be used and any piling which is damaged in driving or which has broken interlocks between sections shall be pulled and replaced at the Contractor's expense.
4. The piling shall be driven within the following tolerances:
   a. Alignment: Sheet pile shall be driven to form a relatively straight line between end points shown on the Drawings. Horizontal deviation of any point from a straight line connecting the two ends of any 30 foot wall section shall be 2 inches maximum. If a cap is used, after capping there shall be no deviation of more than 1 inch in any 30 foot section of the cap.
   b. Plumbness: Each individual sheet pile section shall be driven vertical, within a horizontal tolerance of 2 percent of any vetical length measured along the pile.
   c. Elevation: Tops of sheet pile sections shall be within a tolerance of 1 inch from plan elevations. Contractor shall not be paid for excess sheet pile trimmed off the end of the pile to meet final grade.

C. Contractor shall brace and/or provide soil grading as necessary during construction operations in order to provide lateral stability for the sheet pile wall.

D. Care shall be taken during driving to keep from causing deformations of the top of the piles, splitting the section, or breaking off the interlock between sections. Care shall also be taken during driving to prevent and correct any tendency of the steel sheet piles to twist or get out of plumb.

E. Steel Z-piling shall be driven with the ball-end leading.

F. Alternate Z-piles shall be reversed end for end for proper interlocking in the “normal” position. Piles shall also be aligned properly to maintain a “normal” driving width.

G. For sheet piles driven into the native soils, pre-drilled soils, or excavated soils a vibratory driver may be used as long as the required depth is obtained. Jetting of piles is not permitted.

H. Piles raised during driving of adjacent piles shall be redriven to the required penetration without any additional compensation to the Contractor.

I. Steel sheet piling that is required to be driven beyond its length shall be spliced with additional steel sheet piling with a full penetration butt weld.

J. Temporary steel sheet piling shall be completely removed. At Contractor’s option temporary steel sheet piling may be left in place with the top of the steel sheet piling cut off a minimum of 6 feet below finish grade.

END OF SECTION

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EXTERIOR IMPROVEMENTS

DIVISION 32

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SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work includes construction of new bituminous pavements including associated earthwork, subbase, aggregate, paving and surfacing for all roads, driveways, parking lots, or other paved areas.

B. All work shall be completed in accordance with the Michigan Department of Transportation (MDOT) 2020 Standard Specifications for Construction.

1.02 REFERENCES

A. Michigan Department of Transportation (MDOT), "2020 Standard Specifications for Construction"

B. American Society for Testing and Materials (ASTM), latest edition.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Asphalt Mix Design: Provide job-mix formula prepared by independent lab or approved by MDOT for bituminous leveling and surface courses to Engineer two weeks prior to paving.

C. Certification of quality by producer for the following:
1. Cement
2. Aggregates
3. Asphalt cement
4. Prime coat
5. Bond coat

1.04 JOB CONDITIONS

A. Seasonal Limitations: Seasonal limitations and temperature requirements shall be per the Michigan Department of Transportation (MDOT) 2020 Standard Specifications for Construction.

B. Clean up promptly following pavement installation.

C. Maintenance of Temporary Surfaces: Maintain temporary surfaces until permanent pavement installation is completed.

D. Provide access to the hot mix asphalt (HMA) plant for verification of mix proportions, aggregate gradations, and temperatures.

PART 2 - PRODUCTS

Subbase, aggregate and pavement cross section shall be as shown on the Drawings.

PART 3 - EXECUTION

A. General: Per Michigan Department of Transportation (MDOT) 2020 Standard Specifications for Construction.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the work required for protection and restoration of surface features such as site improvements, concrete sidewalks, asphalt pavement, and all trees, shrubs, lawns, and other landscape features as well as installation of new surface improvements.

B. All areas disturbed by construction operations shall be restored to the original condition thereof or better as determined by the Engineer using information from drawings, surveys, and photographs or video tapes when available.

C. The work shall be performed in accordance with the specifications and drawings, the MDOT 2020 Standard Specifications for Construction, the "Specifications for Surface Restoration" provided in Appendix B, and the following specifications.

1.02 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Topsoil Analysis: Certification of suitability by local agricultural agent (USDA) if requested by Owner or Engineer.

C. Seed Analysis: Certification of purity and germination by manufacturer.

D. Trees and Shrubs: Certification by suppliers of source and species, if requested by Owner or Engineer.

1.03 JOB REQUIREMENTS

A. Areas Disturbed by Construction Operation:

1. Restoration along all utility (water, sewer, forcemain, storm sewer, electrical, etc.) installation including all connection points near buildings and all other areas disturbed during construction.

2. Restoration on site including all areas disturbed during construction.

B. Scheduling:

1. Restoration of Lawns and Other Surface Features: Promptly following curb and gutter, site improvements, and paving.

2. Clean Up: Promptly following restoration.

C. Seasonal Limitations:

1. Seeding: Spring, summer, and fall with mulching from June 1 to September 1.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil, Fertilizer, and Seed: See "Specifications for Surface Restoration".

B. Concrete – See Section 03 30 00 – "Cast in Place Concrete."

C. HMA – See Section 32 12 16 – "Asphalt Paving."

D. Erosion Control Measures: See "Specifications for Surface Restoration".

E. Other Site Improvements: Provide materials equal to or better than those that existed prior to start of construction whether shown or not shown on the drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. All streets, drives, non-motorized paths, sidewalks, and other improved surfaces disturbed by construction operations shall be replaced to uniform lines and grades established by the Engineer. The finish grade line will be established within three (3) inches of the existing ground profile shown on the drawings unless a proposed grade is shown which indicates otherwise.

B. The Contractor shall perform all grading, compacting, shaping, and related work required to prepare the subgrade to the satisfaction of the Engineer.

3.02 RESTORATION

Refer to "Specifications for Surface Restoration" as provided in Appendix B.

END OF SECTION

UTILITIES

DIVISION 33

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SECTION 33 11 13
WATER SUPPLY WELLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the work required for installing one new water supply well to supply wash water to the proposed headworks building, complete with submersible well pump and motor, pitless adapter, hydropneumatic tank, and appurtenant work. Work will also include provision and startup of a VFD controller.

B. All work in this Section shall be performed by a well drilling company licensed to drill water wells in the State of Michigan. The well drilling company must have a minimum of 5 years experience installing minimum 8-inch diameter wells.

1.02 RELATED SECTIONS

A. SECTION 01 33 00 – "Submittals"

B. SECTION 09 96 00 – "High Performance Coatings"

C. SECTION 40 05 13 – "Process Piping"

1.03 REFERENCES

All materials, layout and installations shall meet the requirements of the governing local, state and national codes in effect at the time proposals are received and shall include but not be limited to the following:

A. AWWA A100-15, "AWWA: Standard for Water Wells"

B. AWWA C654-13, "AWWA: Standard for Disinfection of Wells"

C. 1976 P.A. 399, as amended, "Safe Drinking Water Act," and administrative rules promulgated by the State of Michigan.

D. 1978 P.A. 368, Part 127, as amended, "Groundwater Quality Control", and administrative rules promulgated by the State of Michigan.

E. American Society of Testing Materials (ASTM)

1. A53 – Standard Specification for Pipe, Steel, black and Hot-Dipped Zinc-coated, Welded and Seamless
2. C136 – Standard test Method for Sieve Analysis of fine and Coarse Aggregates
3. C150 – Standard Specification for Portland Cement

F. NSF/ANSI Standard 61 – AWWA - Drinking Water System Components.

G. Recommended Standards for Water Works, Great Lakes Upper Mississippi River Board of State Public Health and Environmental Managers (also referred to as Ten States Standards)

1.04 SUBMITTALS

A. In accordance with Section 01 33 00, submit the following:

1. Shop drawings for well casing pipe, well screen, column pipe, filter pack.
2. Dimensional drawings.
3. Name of manufacturer.
4. Type and model of pump and motor

5. Design rotative speed.
6. Number of stages.
7. Type of bowl bearings.
8. Type of lineshaft bearings.
9. Size of shafting.
10. Size of pump column.
11. Size of discharge outlet.
12. OD of pump bowls.
13. Data on shop painting.
14. Total Weight.
15. Complete performance curves showing capacity versus head, NPSH required, efficiency, and bhp plotted scales consistent with performance requirements.
16. Dimensional drawings.

B. Operating, maintenance, and wiring instructions

1. Equipment function, normal operating characteristics, and limiting conditions.
2. Assembly, installation, alignment, adjustment, and checking instructions.
3. Operating instructions for startup, routine, and normal operation, regulation and control, shutdown, and emergency conditions.
4. Lubrication and maintenance instructions.
5. Guide to troubleshooting.
6. Parts lists and predicted life of parts subject to wear.
7. Outline, cross-section, and assembly drawings; engineering data; and wiring diagrams.
8. Test data and performance curves, where applicable. Performance curves shall show the minimum continuous stabilized flow for the bowl assemblies.

C. Water Well and Pump Record as required by the State of Michigan

D. Completed construction print showing details of construction, depth of pump setting, discharge pipe, lineshaft and bearings, etc.

E. All test data generated as a result of testing in paragraph 3.03 of this section.

1.05 WARRANTY

The manufacturer shall warrant their pumps and motors to be free of defects in material and workmanship for a period of one (1) year after the product is first put into operation.

1.06 JOB CONDITIONS

Work shall be completed by a well driller licensed in the State of Michigan with a minimum of 5 years experience installing minimum 6-inch diameter wells.

PART 2 - PRODUCTS

2.01 GENERAL

Materials shall conform to AWWA A-100-06 “AWWA Standards for Water Wells”, and the administrative rules promulgated for “The Safe Drinking Water Act”, 1976 P.A. 399, as amended, and 1978 P.A. 368, Part 127, as amended, which are hereby incorporated into these specifications.

Unless otherwise stated herein, the pump and all related components shall in all respects comply with all local and state sanitary and safety regulations.

2.02 WELL CASING

The well casing shall be new black steel pipe conforming to ASTM A53 standards. The 8-inch (8.625" OD) pipe shall have a wall thickness of 0.322 inches. Joints shall be plain end for welding. Casing may also be SDR-17 PVC casing meeting ASTM F480. The tentative depth of casing is 210 feet below ground level. Base bid shall include the tentative depth of casing. If field conditions dictate that casing should be longer, additional payment will be negotiated in a change order.

2.03 WELL SCREEN

The well screen shall be a minimum 20 feet long, nominal 8-inch diameter pipe size. Screen shall be set from 210 to 230 feet below ground unless conditions identified during drilling warrant otherwise. Changes are to be approved by the Engineer. Screen shall be type 304 stainless steel, wire wound screen as manufactured by Johnson, or approved equal. The screen shall be attached to the casing with a suitable coupling or weld ring. All fittings, except plugs and seals, but including couplings, where required for joining sections of the screen, shall be constructed of the same material as the screen.

The screen slot size shall be 0.010 inches unless formation samples collected during drilling of the proposed well suggest modification would be beneficial. The screen shall retain at least 90% of the filter pack. The proposed screen size and capacity shall be submitted to the Engineer for review prior to installation. The screen shall have a capacity of at least 150 gpm at a maximum entrance velocity of 0.1 feet per second.

2.04 WELL GROUT

Grout shall be neat cement, consisting of Portland Cement, ASTM C150 Type I mixed with a maximum of 6 gallons of water per 94 pound bag of cement.

2.05 FILTER PACK

The gravel/filter pack for placement in the well bore shall be 100% silica having a uniformity coefficient of not greater than 1.5 and shall adequately retain the native formation. The gravel pack size shall be based on sieve analyses from samples obtained during drilling at the proposed depth of the well screen. The 70 percent retained size of the gravel pack shall be approximately 5 times that of the native material. Gravel pack sieve analysis and material information shall be approved by the Engineer before being used.

2.06 CONSTRUCTION WATER

The Contractor must make his own arrangements for obtaining water for drilling. The Owner will make available the existing wells on site for the Contractor's use in construction of the test/production well. The Contractor is responsible for power and pumping equipment.

2.07 PLUG

A temporary cap or plug shall be provided for the finished 8-inch production well which will be removable and will provide a watertight seal.

2.08 DROP PIPE

Discharge drop pipe shall be A53 galvanized steel and shall be 3-inch size. Pump intake setting for base bid purposes shall be at 160 feet below grade. If field conditions dictate that the drop pipe should be longer, additional payment will be negotiated in a change order.

2.09 SUBMERSIBLE PUMP AND MOTOR

A. General: One (1) pump shall be provided and installed. Submersible pump and motor shall be designed for continuous submerged operation.

1. The pump shall be driven by a motor attached below the pump section.
2. Pump unit shall be Grundfos Pump model 85S75-5, or Engineer approved equal. Pump selection will be verified by the Engineer after completion of well testing.

B. System Capacity and Electrical Requirements

1. The pump shall have a capacity of 75 US GPM when operating against a total dynamic head of 212 feet of water.
2. The submersible motor shall be 4-inch diameter and be 7.5 horsepower, rated for 230 volts, 3 phase, 60 hertz.
3. The pump shall be set with its inlet at 165 feet below ground or 5 feet above the top of screen, whichever is shallower.
4. The cable between the motor and service entry shall be submersible with four conductors, 600 volt insulation.

C. Pump Design

1. There shall be a check valve integrally designed into the pump discharge housing.
2. The pump shall have integrated protection against up thrust.
3. The pumping down thrust shall be absorbed by the motor thrust bearing.
4. A filter screen shall be included as part of the suction inlet assembly.
5. Minimum pump efficiency at the design point shall be 68%.

D. Pump Materials of Construction

1. The pump bowls, impellers, guide vanes, strainer, and check valve shall be 300 Series stainless steel. The shaft and coupling shall be 300 or 400 Series stainless steel. No moving parts shall be constructed from plastic or other brittle materials.
2. The intermediate and top bearings shall be Nitrile Rubber (NBR).

E. Motor Design

1. The motor shall be a squirrel-cage induction motor designed for continuous underwater operation in conformance with NEMA standards. Motor shall be premium efficiency.
2. The motor shall have a Kingsbury-type or Michell thrust bearing capable of carrying the maximum pump thrust loads.
3. The motor shall be water filled for cooling and lubrication. No oil or grease lubrication shall be used.
4. A flexible diaphragm shall be provided to permit expansion and contraction of the internal motor fluid when the motor heats and cools during operation.
5. A shaft seal shall be provided to insure the internal motor fluid is not mixed with the pumped fluid.

F. Motor Materials of Construction

1. The motor diaphragm shall be Nitrile Rubber or Type 100 Hydrin.
2. The shaft seal shall be a Nitrile Rubber lip seal or a Nitrile, Carbon, Carbide and/or Ceramic face seal.
3. The motor shall be of 300 Series stainless steel.

2.10 HYDROPNEUMATIC TANK

Tank shall be Amtrol Well X Trol WX-251 or approved equal with minimum pressure rating of 150 psig. Tank shall be located as indicated on the Drawings. Tank precharge shall be adjusted to 3 psig lower than the pump start pressure setpoint. All piping and fittings necessary to connect the tanks to the mechanical room piping shall be provided and installed. Plumbing to each hydropneumatic tank shall include an isolation valve and a drain.

2.11 PITLESS ADAPTER

An 8-inch pitless adapter shall be furnished for the well pump discharge. Pitless adapter shall be industrial grade as manufactured by Baker Manufacturing Company or approved equal. The pitless adapters shall allow removal of the pump without requiring reopening of the well casing below grade and shall provide an above-grade sealed entrance for the pump power and control wires.

Pitless Adapter case shall be steel, designed for connection to the steel well casing. Discharge body, spool, vent, and cap shall be cast iron. The units shall be factory assembled before shipping to the site and must conform to the Recommended Standards for Water Works, Great Lakes Upper Mississippi river Board of State Public Health and Environmental Managers.

Connections for discharge piping shall be furnished to provide a restrained transition from the standard steel discharge pipe of the pitless adapter and the buried water discharge line. The entire assembly shall be designed for a working pressure of 250 psig with an allowance of 100 psig for pressure surges.

The pitless adapter well cap shall be sealed watertight, and located a minimum of 24 inches above finished grade. The unit shall be designed so that water is not allowed above the discharge elevation to prevent freezing. The well cap shall be provided with a 24 mesh screened vent. A factory assembled lift out pipe and bail shall be provided for the removal of the pump and discharge pipe column.

The pitless unit shall be factory painted with a rust protective alkyd coating.

2.12 ACCESSORIES

A. Air Gauge

An air line gauge shall be provided that is calibrated to read feet of water below the floor elevation. Air piping of 1/4 –inch Type-L copper tubing shall be carried down in the casing to the top of the pump. The tubing shall be attached securely to the pump column in a manner as to prevent the entrance of foreign materials. A suitable air pump shall be provided.

2.13 VARIABLE FREQUENCY DRIVE/CONTROLLER

The well driller shall provide a Yaskawa IQ Pump VFD controller for use with the new submersible well pump. Install all electrical conduit and conductors required for a complete system from the power supply to the proposed VFD. Well driller shall be responsible for wiring from the VFD to the submersible well pump.

Variable Frequency Drive/Controller shall be Yaskawa IQ Pump appropriately sized and rated for the selected submersible pump. Load and line filters shall be included and shall be by Transcoil or Engineer approved equal. Lightning arrestor/surge capacitor shall also be provided and installed and shall be Delta Models LA603/CA603R. The VFD and accessories are available from Fuller Supply Co., 616-364-8455.

Electrical subcontractor shall complete all power supply wiring to the VFD from the proposed headworks building power supply including all wire and conduit to the VFD and work necessary at the existing power panels. It shall be the Contractor's responsibility to visit the site and determine all electrical work necessary for a complete, functional system.

Well driller shall mount the VFD in the headworks building electrical room and complete all programming and startup of the system. All necessary adjustments to control parameters to provide smooth control without pressure spikes or excessive cycling of the pumps shall be completed by the well driller.

The VFD shall monitor the pressure transmitter and shall be programmed such that the speed of the pump is smoothly varied to maintain an initial pressure setpoint of 80 psig. If the minimum speed of the pump (selected in the field) is reached for 10 seconds, the pump shall be shut down. The system should then stay off until the pressure reaches a setpoint of 70 psig at which time the VFD will start the pump and again seek the pressure setpoint of 80 psig. If the pressure transmitter records a pressure lower than an operator-selected setpoint, the VFD/controller shall send a low-pressure alarm signal to the SCADA system. Well driller shall coordinate with the instrumentation contractor to provide necessary signals to SCADA system.

2.14 PRESSURE TRANSMITTER

A. Provide gauge pressure transmitters for each pressure control application.

B. Pressure Transmitter Requirements: The operating ranges shall be calibrated to 0-100 psi gauge. Design is based on Grundfos or Danfoss, 4-20mA Stainless Steel pressure transmitter unit. Equal performance products by Rosemount, and ABB are acceptable per Engineer approval. All wetted materials must be NSF61 approved for use with drinking water. Provide and install with an isolation valve inside headworks building on hydropneumatic tank supply piping.

2.15 PRESSURE SWITCH

A. Provide pressure switch for low pressure alarm notification. Pressure switch shall be a single setpoint field adjustable with a fixed deadband.

B. Pressure switch actuatorshall be constructed of Buna, and shall have a ¼” female port.

C. Pressure switch enclosure shall be a NEMA 4/4X & IP66 rated watertight and corrosion resistant enclosure.

D. Pressure swith shall be a setpoint range of 0 to 100 psi. Switch shall be accurate to 1% of setpoint pressure. Initial setpoint shall be 50 psi.

E. Pressure switch output shall be single pole double throw contact rated at 120VCA for 10 amps.

F. Acceptabke manufacturers are Ashcroft, L-Series, Model LPS, or Engineer approved equal.

2.16 DISCHARGE PIPE AND CONNECTION TO HEADWORKS

The Contractor shall verify material and size of piping in the headworks building and connect to the proposed headworks building piping with necessary fittings.

Discharge pipe from the well shall be 4-inch Class 53 ductile iron pipe conforming to AWWA C151 and C150 with cement mortal lining with seal coat conforming to AWWA C104. Seal coat shall have NSF61 approval for use with potable water. Contractor shall supply all necessary transition fittings to connect to the pitless adapter and headworks building water piping. Pipe shall be buried with a minimum cover of 5 feet over to crown of the pipe. Any piping buried with less than 5 feet of cover shall be covered with rigid foam insulation board per the requirements of Section 33 14 13 Water Utility Distribution Piping. All connections and pipe joints shall be restrained.

All buried exterior ductile iron pipe shall be encased in seamless polyethylene sleeve per section 4.02.07 of “Standard Specifications for Watermain” in Appendix B.

PART 3 - EXECUTION

3.01 GENERAL

A. Protection of Quality of Water

1. *Precautions to be Taken:* The Contractor shall take such precautions as are necessary or as may be required permanently to prevent contaminated water or water having undesirable physical or chemical characteristics from entering, through the opening made by the Contractor in drilling any wells, any groundwater. Contractor shall also take all necessary precautions during the construction period to prevent contaminated water, gasoline, or any other contaminant from entering the well, either through the opening or by seepage through the ground surface.

   The Contractor shall secure the top of the well casing each night and during all periods when no work is being done on the wells in order to prevent accidents or vandalism. The well shall be furnished with a lockable or tack welded steel plate cover for this purpose.

2. *Corrective Work:* In the event that the well becomes contaminated or that water having undesirable physical or chemical characteristics enters the well because of the neglect of the Contractor, he shall, at his own expense perform such work or supply such casings, seals, sterilizing agents or other material as may be necessary to eliminate the contamination or shut off the undesirable water.

B. Construction Water: The Contractor must make his own arrangements for obtaining water for drilling.

C. Power and Pumping Equipment: The Contractor is responsible for power needs during drilling of the new well and any temporary pumping equipment needed for testing.

D. Contractor shall obtain any permit required by the Muskegon County Health Department for installation of the well.

3.02 INSTALLATION

All work to be performed by a water well driller licensed in the State of Michigan. Installation shall conform to the references cited above in paragraph 1.03.

A. Polit Hole

A 4-inch pilot hole shall be completed prior to drilling the test/production well in order to log the formation and collect samples at the location of the permanent well. Drilling shall be conducted to the bottom of the sand aquifer, or to a depth of not more than 230 feet. Drill cuttings shall be collected every 5 feet or at every change in formation, whichever is less, placed in bags labeled with the date, depth, and well number. Samples shall be collected in saturated zones every 5 feet where the formation is changing or every 10 feet where it is uniform. All samples shall be retained by the Contractor until the completion of the project. These samples along with the driller's log and well construction print shall be delivered to the Engineer.

The samples collected in the targeted saturated zone shall be of adequate size to conduct grain size analyses if so requested by the Engineer or Owner. The Contractor shall perform the grain size analyses according to the most recent versions of ASTM Standards C-136M-14 and D-7928-17 and provide all results to the Engineer. A total of six (6) sieve analyses should be assumed for bidding purposes.

B. 8-Inch Cased Hole

1. *Drilling Method:* The acceptable methods of drilling are rotary or reverse-rotary methods. All methods shall comply with AWWA Specification A-100-06 "AWWA Standard for Water Wells". The borehole shall be a minimum 16-inch diameter.

2. *Screen Placement:* The screen shall be 20 feet long. The screen interval is anticipated to be from approximately 210 to 230 feet below ground level unless conditions identified during drilling warrant otherwise. Changes are to be approved by the Engineer.

3. *Filter Pack*: Place filter pack around screen with a tremie pipe from the bottom to a height of 10 feet above the top of the screen. Dumping of gravel into the well bore shall not be allowed. Filter pack shall have a minimum thickness of 2 inches.

4. *Well Grouting:* A 2-foot thick bentonite seal shall be placed immediately above the gravel pack. From the top of the bentonite seal to the ground surface, the annular space shall be pressure grouted. All grouting shall be in conformance with MDEQ regulations using neat cement, consisting of Portland Cement, ASTM C150 Type I mixed with a maximum of 6 gallons of water per 94 pound bag of cement. Grout must be placed with a grout pipe from the bentonite seal to the ground surface.

5. *Well Development:* The initial well development shall be by flushing and/or pumping to clear all drill cuttings from the bore hole and shall continue until clear water is obtained. A pump, capable of producing at least 250 GPM, shall then be installed in the well and the well further developed by surging at maximum capacity until the produced water remains clear.

   The development records required to be submitted as part of the daily work reports shall include:
   - Quantity and description of material brought into the well,
   - Static and pumping water levels,
   - Methods of measurement,
   - Duration of each operation,
   - Observation of results,
   - Production rates and specific capacity,
   - Sand content as a function of production rate and time,
   - Sand content as a function of production rate and specific capacity, and
   - Any other pertinent information.

   It shall be the responsibility of the Contractor to do such work, at his own expense, as may be necessary to meet the sand content requirement. Failure of the Contractor to meet this requirement may cause the Owner to refuse to accept the well.

   The Contractor shall assume a total approximate development time of 8 hours.

6. *Initial Well Disinfection:* Immediately upon completion and clearing of the well, an initial disinfection of the well shall be completed by the Contractor. The CONTRACTOR shall disinfect the well by use of enough chlorine solution to provide a concentration of available chlorine of not less then 50 mg/l in the volume of water contained within the well bore. After the chlorine solution has been in the well for 24 hours, the contractor shall pump water from the well until no chlorine remains. Upon completion of the initial chlorination, testing may begin.

3.03 FIELD TESTING AND OBSERVATION

A. General:

1. Notification: Contractor shall notify Engineer at least 48 hours prior to any testing so that the Engineer may witness the test.
2. Provide necessary equipment, manpower and assistance.

B. Yield and Drawdown – New Well

Testing shall be completed as follows prior to ordering pump so that pump requirements can be verified.

A test shall be conducted upon completion and development of the well. The test shall consist of pumping the well for 4 hours at a rate of 150 gpm and monitoring drawdown every 5 minutes for the first hour and every 30 minutes thereafter. The pumping rate shall be measured by a calibrated free fall orifice pipe with a gate valve installed at the pump head to regulate the flow or by another device that has a minimum accuracy of 95%. Water level measurements shall be taken in the pumped well by electric measuring device to the nearest 0.01 foot. All water shall be discharged on site to a location at least 300 feet from the test/production well. This location shall be determined in consultation with Owner and Engineer.

The actual pumping rate shall be recorded after each water level reading is taken.

C. Permanent Pump Performance

After installation of the permanent pump, the Contractor shall verify proper operation of the pump by pumping for 1 hour and recording flow, discharge pressure and water level in pumping well every 15 minutes.

3.04 FINAL DISINFECTION

Contractor shall complete final disinfection,water sampling, and sample analysis as required by the Oceana County Health Department. Results of all water samples shall be provided to the Owner and Engineer.

3.05 ADJUST AND CLEAN

General: Keep pipe and structures clean as work progresses. The Contractor shall completely remove from the sites all rubbish, debris, equipment, and material caused by the performance of the work described in this specification. All disturbed surfaces shall be restored to their condition prior to the start of work or better.

END OF SECTION

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SECTION 33 14 13
PUBLIC WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. The work covered by this section consists furnishing all supervision, labor, materials, and equipment necessary for installation of drinking water site piping, valves, fittings, and accessories below ground.

1.02 RELATED SECTIONS

A. SECTION 01 33 00 – "Submittals"

B. Division 31 – Earthwork

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Submit data on all pipe, poly-wrap, valves, hydrants, fittings, curb stops, corporation stops, and gaskets.

1.04 JOB CONDITIONS

A. Maintain existing water systems during construction. Limit service interruptions to existing systems to minimum time required for installation of new system.

PART 2 - PRODUCTS

See "Specifications for Water Mains" in Appendix B that are hereby made part of this Specification.

Potable water 1-inch diameter water service from the existing WWTF facility to the yard hydrant near the Inlet/Splitter box shall be copper, meeting requirements of "Specifications for Water Mains" in Appendix B.

Extruded Polystyrene Board Insulation: Rigid, cellular polystyrene thermal insulation with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C578 for type indicated; with 5-year aged R-value per inch of 5 at 75 deg F. Maximum flame spread and smoke developed values of 10 and 200, respectively.

1. Type VI, 1.8 pcf minimum density and 40 psi minimum compressive strength.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) "Styrofoam Highload 40," DuPont.

      2) "Foamular 404," Owens Corning, or equivalent.

PART 3 - EXECUTION

See "Specifications for Water Mains" and "Specifications for Excavating, Trenching, and Backfilling for Utilities" in Appendix B, which are hereby made part of this specification.

Place 4-foot wide, 4-inch thick insulating material 4 inches above top of pipe and centered over pipe for all pipe with less than 5 feet of earthen cover.

END OF SECTION

SECTION 33 15 00
AIR SUPPLY PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. The work covered by this section consists furnishing all supervision, labor, materials, and equipment necessary for installation of air supply piping, valves, fittings, and accessories below ground.

1.02 RELATED SECTIONS

A. SECTION 01 33 00 – "Submittals"

B. Division 31 – Earthwork

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Submit data on all pipe, poly-wrap, valves, fittings, corporation stops, and gaskets.

1.04 JOB CONDITIONS

A. Maintain existing air supply systems during construction. Limit service interruptions to existing systems to minimum time required for installation of new system.

PART 2 - PRODUCTS

See "Specifications for Water Mains" in Appendix B that are hereby made part of this Specification.

Buried air supply piping 4-inch diameter and larger shall be ductile iron meeting requirements of "Specifications for Water Mains" in Appendix B. All air supply piping shall be restrained. "Gripper" style gasket shall not be an acceptable means of restraint.

Due to system operating temperatures, all ductile iron piping and fittings for air service shall be cement mortar lined meeting ASTM C150without seal coat. Gasket material shall resist degradation for airline temperatures to 250 degrees Fahrenheit. Gaskets shall be EDPM or engineer approved equal.

All buried exterior ductile iron air supply pipe shall be encased. Due to system operating temperatures, High Density Cross Laminated Polyethylene film encasement (HDCLPE) rated for 220 degrees Fahrenheit and meeting ANSI/AWWA C105/A21.5 Standard shall be provided. AA Thread Seal Tape 4-mil high density cross laminated polyethylene film shall be provided at each joint.

Buried air supply piping and condensate release piping 2-inch diameter and smaller shall be copper pipe in accordance with ASTM specification B88 for Type K annealed, seamless copper. Corporation stops at the connection to copper condensate release lines shall be compression type copper connection Mueller company P-2500t*, Ford FB1000 (compression fitting), or Engineer approved equal. Unless otherwise approved, all copper pipe shall have no unions below ground.

PART 3 - EXECUTION

See "Specifications for Water Mains" and "Specifications for Excavating, Trenching, and Backfilling for Utilities" in Appendix B, which are hereby made part of this specification.

Hydrostatic leakage test shall be conducted at pressure of 20 psi for 2 hours. No leakage shall be allowed.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. The work covered by this section consists furnishing all supervision, labor, materials, and equipment necessary for installation of sanitary force main site piping (from the Polishing Pond Pump Station and Biosolids Pumping Station) and buried process piping, fittings, valves and accessories below ground.

B. Buried process piping includes: Raw Wastewater Influent (RAW), Aeration Basin Inlet (AI), Waste Activated Sludge (WAS), Biosolids Transfer/Decant, Aeration Basin Outlet, Berm Overflow Piping, Clarifier Influent and Effluent Piping, and any other buried piping not otherwise specified.

1.02 RELATED SECTIONS

A. SECTION 01 33 00 – "Submittals"

B. SECTION 31 23 00 – "Site Grading, Excavation, and Backfill"

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Submit data on all sanitary sewer force main, buried process piping, valves, fittings, gaskets, and accessories.

1.04 JOB CONDITIONS

A. Maintain existing sanitary sewer system during construction. Limit service interruptions to existing systems to minimum time required for tie-ins to proposed sanitary sewer.

B. Do not bypass wastewater to ground or surface waters.

PART 2 - PRODUCTS

Products shall meet requirements of the "Specifications for Force Mains" in Appendix B. Buried force main piping from the Polishing Pond and Biosolids Pump Stations shall be HDPE pipe where indicated in the Drawings. HDPE pipe, transitions, and fittings used as force main shall comply with "Specifications for Force Mains" and shall be IPS DR 13.5, HDPE PE 4710. HDPE/ductile iron transition shall be made five (5) feet outside the Biosolids Pump Station valve chamber. HDPE test pressure shall be 100 psi.

Contractor shall install restraint collars cast in concrete on HDPE pipe adjacent to all connections to ductile iron pipe where shown in the Drawings or restrain the pipe by other means as approved by the Engineer. Size of concrete block at connection shall be sufficient to resist forces due to thermal expansion/contraction and due to the Poisson effect as calculated per guidance from the Plastics Pipe Institute.

Unless otherwise noted, all buried process piping and fittings shall be ductile iron in accordance with the "Specifications for Force Mains".

All buried exterior ductile iron pipe shall be encased in seamless polyethylene sleeve per section 7.02.05 of "Specifications for Force Mains" in Appendix B.

Buried force main valves and buried process piping valves shall be in accordance with the resilient wedge gate valves specified in the "Specifications for Force Mains", or the buried service plug valves specifications below, depending on the type of valve noted in the Valve Schedule.

Plug valves for buried service shall meet requirements of Section 40 05 51 Process Valves, except that buried actuators shall be 90% grease filled. Input shaft and fasteners shall be stainless steel, and actuator mounting brackets shall be totally enclosed. End connections for buried plug valves shall meet or exceed the latest revisions of AWWA C517 and other applicable standards. End connections for buried service plug valves shall be mechanical joint per AWWA C111. Manual valves shall be provided with operators indicated in the Valve Schedule. Operators for buried plug valves shall be a 2" operating square nut with valve box. Valves shall open left. For valves installed in a horizontal pipeline, install the valve so the plug rotates up when opened. Where drain-back does not exist, install the valve with the higher pressure, when closed, against the end opposite the seat.

Extruded Polystyrene Board Insulation: Rigid, cellular polystyrene thermal insulation with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process to comply with ASTM C578 for type indicated; with 5-year aged R-value per inch of 5 at 75 deg F. Maximum flame spread and smoke developed values of 10 and 200, respectively.

1. Type VI, 1.8 pcf minimum density and 40 psi minimum compressive strength.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) "Styrofoam Highload 40," DuPont.

        2) "Foamular 404," Owens Corning, or equivalent.

PART 3 - EXECUTION

See “Specifications for Force Mains” and “Specifications for Excavating, Trenching, and Backfilling for Utilities” in Appendix B, which is hereby made part of this specification.

Place 4-foot wide, 4-inch thick insulating material 4 inches above top of pipe and centered over pipe for all pipe with less than 5 feet of earthen cover.

END OF SECTION

SECTION 33 31 50
BYPASS PUMPING

PART 1 - GENERAL

1.01 GENERAL

A. This section covers provision of temporary bypassing by the Contractor as required for the Work.

B. Contractor shall maintain wastewater flows through the existing system at all times during construction. Wastewater shall not be allowed to back up and surcharge within the system. No spills into the environment will be permitted.

C. The Contractor shall be responsible for any fines or damage as a result of failure of the bypass operation and shall indemnify the Owner and Engineer from any liability from claims resulting from failure of the bypass operation.

1.02 SUBMITTALS

A. The Contractor shall submit a Bypass Operation Plan to the Owner and Engineer for review. All changes to the plan must be reviewed by the Owner and Engineer.

B. The Contractor shall prepare and maintain an emergency plan capable of handling total flows.

PART 2 - PRODUCTS

2.01 GENERAL

A. Bypass operation required involves connection of bypass piping to a 12-inch diameter riser at the northwest corner of the north aeration basin. The bypass riser will be installed by Others as part of a separate job. Bypass operations will utilize the existing pumps at the Griswold Lift Station and will discharge directly from the bypass riser to the east end of the north aeration basin.

B. Contractor shall be responsible for supplying and installing bypass piping from the 12-inch bypass riser to the proposed bypass discharge location in the north aeration basin. Piping shall be sized in order to accommodate peak flows from the Griswold Lift Station.

C. Average daily influent flow rate to the Griswold Lift station is approximately 800,000 gpd. Peak wet weather flows may be substantially higher than the rate given depending on rainfall intensity.

The existing lift station has a peak capacity of 3,500 gpm.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall perform all work associated with bypassing without causing damage to the existing system and without causing spills into the environment. Any damage resulting from the Contractor's work shall be repaired or replaced at no expense to the Owner.

END OF SECTION

[Intentionally left blank]

PART 1 - GENERAL

1.01 SCOPE

The work in this section shall include all labor, equipment, and materials furnished, installed and placed into operation as specified herein or indicated on the Drawings for two complete duplex submersible lift stations. The two stations specified in this section are as follows:

- Polishing Pond Pump Station
- Biosolids Pump Station

Submersible lift stations shall include wet well, valve chamber, submersible pumps, all piping and valves inside and between chambers, electrical power supply, instrumentation, controls, and all accessories necessary for a complete, functioning system.

1.02 SUBMITTALS

A. Submit in accordance with the General and Supplementary Conditions and Section 01 33 00 – "Submittals."

B. Submit detailed shop and installation drawings to the Engineer for review for all submersible lift station equipment and accessories.

1.03 QUALIFICATION REQUIREMENTS

A. These plans and specifications have been prepared on the basis of using equipment listed as base bid. The proposal allows for other suppliers with an appropriate deduct or add for other equipment. See Section 01 60 00 – "Materials and Equipment."

B. Prior to bidding, the Manufacturers shall furnish the Engineer complete descriptive information pertaining to the alternate equipment offered to meet the specifications. Failure to provide this information will be grounds for rejection of equipment.

C. Only equipment of those Manufacturers with five or more years' experience who have furnished like equipment and specialties for at least five similar lift stations that have been in regular operation not less than two years will be considered as an alternate. Evidence of experience and operational data may be required from the manufacturer to determine the suitability and efficiency of the equipment offered.

1.04 OPERATIONAL REQUIREMENTS

A. System Operation Requirements: Submersible lift station shall be equipped with a duplex pumping system. Pumps shall operate based on the water level in the wet well as measured by a primary level transmitter. Pump control levels shall be as defined in the Drawings.

B. Manufacturer's Service Engineer: Contractor shall furnish the services of a competent Manufacturer's Service Engineer, if necessary during construction. Manufacturer's Service Engineer shall be on the site at the time of initial operation of the Manufacturer's equipment, and shall approve the installation before it is placed into service. Additional services of the Manufacturer's Service Engineer shall be as detailed herein.

C. Operating Instructions: The Contractor shall furnish, upon completion of the equipment installation and before initial operation, sets of complete operating instructions for all equipment furnished and installed under this contract per Section 01 33 00 - "Submittals."

D. Lubrication and Tools: All equipment shall have facilities for lubrication conveniently located. The Contractor shall provide lubrication equipment that will be necessary for proper maintenance. The Contractor shall also provide maintenance instructions and one year's supply of recommended lubricants for each item of equipment properly labeled.

The Contractor shall furnish any special tools necessary for proper maintenance and adjustment of the equipment.

PART 2 - PRODUCTS

2.01 PRECAST STRUCTURES

Precast wet well and valve chamber structures, including steel reinforcement, flexible manhole connectors, and manhole steps, shall be in accordance with the Drawings and with the "Standard Specifications for Sanitary Sewer" included in Appendix B. Access hatches, where required, shall be integrally cast into the flat tops. Extra reinforcing steel shall be added at hatch corners as needed to support 100 psf live load plus deadload.

2.02 SUMP PUMPS

The Biosolids Pump Station valve chamber shall have a sump and sump pump furnished and installed as shown on the Drawings. The sump shall be an 18-inch diameter PVC pipe set in grout as shown on the Drawings.

The sump pump model shall be Goulds LSP03, 1/3 HP, with built-in float switch and 3-prong grounding plug. Discharge pipe shall be glued schedule 40 PVC and shall have double check valve and isolation valve and shall discharge water from the valve chamber sump to the wet well.

2.03 FLOOR DRAINS

The Polishing Pond Pump Station valve chamber shall have an integrally cast floor drain furnished and installed as shown on the Drawings. Floor Drain shall be 8-inch Jay R. Smith Model 2040. Floor drain shall have integral trap and cleanout.

Drain piping shall be 4-inch Schedule 40 PVC pipe and fittings.

2.04 VENTS AND CARBON FILTERS

Provide stainless steel vents at locations shown in the Drawings. Stainless steel vent tube piping shall be 6 inch Schedule 10 Type 304 stainless steel. Vent tube shall include a down turned "gooseneck" with carbon filter insert. The vent shall be integrally cast in the top slab. The use of Link-Seals will not be allowed. Carbon filter insert shall be "Vent Pure" as manufactured by General Carbon Corporation or Engineer approved equal.

2.05 PIPING AND VALVES

Piping within the submersible lift station structures shall be as specified in Section 40 05 13 – "Process Piping." Buried piping shall be as specified in Section 33 31 23 – "Sanitary Sewer Force Main."

Valves shall be as specified in Section 40 05 51 – "Process Valves" and as shown on the Drawings.

2.06 SUBMERSIBLE PUMPING UNITS

Submersible pumps shall be guide bar mounted submersible wastewater pumps in a precast concrete wet well as shown in the Drawings and specified herein. Base bid shall include equipment as manufactured by Flygt.

Furnish and install a duplex submersible lift system. Pumps shall be explosion proof rated for a Class 1, Division 1 atmosphere. Each pump shall be equipped with a submersible electric motor for 460 volt, 3 phase, 60 hertz operation. Motor shall be capable of being driven by a variable frequency drive (VFD). The pumping units shall have the following characteristics:

Polishing Pond Pump Station:

Model No.	NP3171 MT 3~ 434
Capacity	1,200 gpm
TDH	66 ft
Motor w/ VFD	34 hp

Biosolids Pump Station:

Model No.	NP3069 MT 3~ 436
Capacity	200 gpm
TDH	12 ft
Motor w/ VFD	2.4 hp

A. Pump Design

Each pump shall be supplied with a mating cast iron discharge connection. The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two stainless steel guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well to access the pump. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring or profile gasket shall not be acceptable. No portion of the pump shall bear directly on the sump floor. Each pump shall be fitted with stainless steel lifting chain. The working load of the lifting system shall be 50% greater than the pump unit weight.

B. Pump Construction

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts or bolts shall be AISI type 316 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit.

Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

Motors shall be sufficiently cooled by the surrounding environment or pumped media. A water cooling jacket will not be accepted.

Each unit shall be provided with an integral motor cooling system above 10 hp. A stainless steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow

providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The seal hosing shall also have a drain installed consisting of a stainless steel close nipple, ball valve with locking handle and stainless steel pipe plug. This allows the coolant to be drained without removing the pump for maintenance checks and coolant change. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

C. Cable Entry Seal

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal.

D. Motor

The pump motor shall be a NEMA B design, induction type, capable of variable frequency drive operation, with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F) (Polishing Pond Pump Station) or Class F insulation rated for 155°C (311°F) (Biosolids Pump Station). The stator shall be insulated by the trickle impregnation method using Class H/Class F monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be premium efficiency, inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process shall not be acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing shall not be acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 30 (Polishing Pond Pump Station) or 15 (Biosolids Pump Station) evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. The thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The motor and the pump shall be produced by the same manufacturer.

The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A performance chart shall be provided showing curves for torque, current, power factor, input/output kW and efficiency. The chart shall also include data on starting and no-load characteristics.

The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The power cable shall be of a shielded design (if required to prevent interference with controls) in which an overall tinned copper shield is included and each individual phase conductor is shielded with an aluminum coated foil wrap. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater. The manufacturer is responsible to determine cable compliance with variable frequency drives provided in the control panel. If non-shielded cables are provided and interference is present the manufacturer is responsible to provide parts and labor to change to shielded cable at no cost to the Owner.

The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

E. Bearings

The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease.

For motor hp < 12, the upper bearing shall be a single deep groove ball bearing. For motor hp > 12, the upper bearing shall be a two row angular contact bearing to handle radial loads. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings shall not be acceptable. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve. Bearings shall be protected from stray voltage.

F. Mechanical Seal

Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary and one positively driven rotating, corrosion resistant tungsten-carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub will not be acceptable. For special applications, other seal face materials shall be available.

The following seal types shall not be considered acceptable or equal to the dual independent seal specified: shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces. No system requiring a pressure differential to offset pressure and to effect sealing shall be used.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load. Seal lubricant shall be FDA Approved, nontoxic.

G. Pump Shaft

Pump and motor shaft shall be the same unit. The pump shaft shall be an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be stainless steel – ASTM A479 S43100-T.

H. Pump Impeller

The impeller shall be of ASTM A-532 Alloy III A 25% chrome cast iron dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the gray iron impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to

volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

I. Volute/Suction Cover

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of ASTM A-532 Alloy III A 25% chrome cast iron and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

J. Protection

All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.

A leakage sensor shall be used to detect water in the stator chamber. The sensor shall stop the motor and send an alarm in the presence of water. Use of voltage sensitive solid state sensors and trip temperature above 125°C (260°F) shall not be allowed.

The thermal switches and leakage sensor shall be connected to a Mini CAS (Control and Status) monitoring unit. The Mini CAS shall be mounted in the submersible lift station control panel.

K. Start-Up Service

A factory authorized start up technician with a minimum of 5 years' experience shall be provided to visit the site and confirm operation of pumps and controls meets or exceeds the specifications. The service technician shall be outfitted with a service crane truck capable of pulling the pumps. The service technician shall complete the following tasks at a minimum:

a. Verify rotation and perform a check of the pumps
b. Inspect pump/s cables for damage.
c. Verify proper base and rail installation.
d. Check seal lubrication.
e. Check for proper rotation.
f. Check power supply voltage.
g. Measure motor operating amperage load and no load amperage.
h. Perform shut off head test and draw down flow test.
i. Check level control operation, sequence and alarm call out of telemetry.

The factory start up form shall be submitted to the Engineer for approval prior to start up.

A detailed start-up report shall be submitted to the Owner.

During start-up inspection, the manufacturer's service representative shall review recommended operation and maintenance procedures with the Owner's personnel.

L. Detail Plate

A stainless steel plate stamped or engraved with the following information shall be affixed to the control panel inner door, MCC or other location as directed by the Owner/Engineer:

Pump manufacturer, model and serial number

Duty point gpm & TDH

Phase, voltage, HP & RPM

Cable length

Warranty and clog free guarantee start and end date

Manufacturer's authorized service center name and contact phone number

M. Clog-Free Guarantee

The manufacturer shall guarantee clog-free operation for a period of 12 months from the date of start-up of the pumps by the local authorized factory representative. A certificate shall be provided to the Owner on the day of start up with the local contact information and effective date. Should the impeller clog with typical solids and/or modern trash debris normally found in domestic wastewater during this period, an authorized representative shall either travel to the jobsite remove the pump, clear the obstruction and reinstall the pump at no cost or reimburse the Owner for reasonable cost to provide this service. A written report shall be provided to the Owner detailing the service call with pictures for verification purposes.

N. Warranty

Pumps shall be provided with a non-prorated, 100% 5 year warranty against defects in materials and or workmanship. The warranty shall cover the entire pump not individual components. Upon warranty occurrence, the manufacturer's authorized service center shall remove the pump, repair, reinstall and provide start up on the repaired pump. A detailed failure analysis shall be submitted to the Owner for their records summarizing corrective action taken. In the event that the repair cannot be done within 4 weeks of removal, a loaner pump shall be provided to the Owner within 1 week until such time that the repaired pump can be returned. Installation and removal of the loaner pump shall be provided by the manufacturer's representative. Upon request from the Owner the pump supplier shall provide a warranty bond covering the above requirements.

2.07 PRESSURE GAUGES

See Section 40 05 13 – "Process Piping."

2.08 ACCESS HATCHES

Access hatches with safety grates and safety chains shall be installed as shown on the Drawings and meet the requirements as specified in Section 08 31 00.

2.09 PUMP CONTROLS

See Section 40 91 00 – "Process Instrumentation," Section 40 95 10 – "Pump Station Control Panels," and Section 40 96 35 – "Process Control System" for electrical/controls equipment requirements. See Section 40 95 10 for electrical/controls equipment requirements.

2.10 TELEMETRY

See Section 40 96 35 – "Process Control System" for telemetry requirements.

2.11 ELECTRICAL EQUIPMENT

See Division 26 – "Electrical Specifications" for electrical equipment requirements.

PART 3 - EXECUTION

3.01 GENERAL

All submersible lift station components and equipment shall be installed in accordance with the Manufacturer's instructions and these Drawings and specifications. All conduit and interconnecting wiring shall be supplied and installed by the Contractor.

3.02 CONCRETE

Concrete pads and frost walls required around the submersible lift station structures and for the electrical and control panels shall meet all requirements of Section 03 30 00 – "Cast in Place Concrete."

3.03 PAINTING

Equipment in the wet well and valve chamber shall be painted in accordance with Section 09 96 00 – "High Performance Coatings." Touch-up of damaged surfaces will be required. Do not paint over code required labels such as UL or FM, equipment identification nameplates, and moving parts of operating mechanical and electrical equipment.

3.04 SEQUENCE OF OPERATION

See Section 40 96 35 – "Process Control System."

3.05 PERFORMANCE TEST AND TRIAL OPERATION

See Section 01 75 00 – "Starting and Adjusting."

END OF SECTION

SECTION 33 40 00
STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. The work covered by this section consists furnishing all supervision, labor, materials, and equipment necessary for installation of storm drainage utilities.

1.02 RELATED SECTIONS

A. SECTION 01 33 00 – "Submittals"

B. SECTION 31 23 00 – "Site Grading, Excavation, and Backfill"

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – "Submittals."

B. Submit data on all storm sewer pipe, culverts, catch basins, castings, manholes, fittings, gaskets, and accessories.

1.04 JOB CONDITIONS

A. Maintain existing storm sewer system during construction. Limit service interruptions to existing systems to minimum time required for tie-ins to proposed storm sewer.

PART 2 - PRODUCTS

2.01 Reinforced Concrete Pipe

All storm sewer unless specifically noted otherwise, shall be Class IV reinforced concrete pipe in accordance with the "Specifications for Storm Sewer" in Appendix B, which is hereby made part of this specification. Flared end sections shall be reinforced concrete flared end sections.

2.02 Underdrains

Materials for underdrains and drain tiles shall conform to the requirements of Section 404 of the MDOT 2020 Standard Specifications of Construction.

2.03 Other

All other storm sewer products including catch basins and castings shall be in accordance with the plans and the "Specifications for Storm Sewer", included in Appendix B.

PART 3 - EXECUTION

See "Specifications for Storm Sewer" and "Specifications for Excavating, Trenching, and Backfilling for Utilities" in Appendix B, which are hereby made part of this specification.

END OF SECTION

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WATERWAY AND MARINE CONSTRUCTION

DIVISION 35

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections apply to this document.

1.02 SUMMARY

A. The Contractor shall furnish and install all floating dock systems and gangways as shown on the Drawings complete with all accessories and appurtenances required for the proper performance of the work.

B. The floating dock supplier and manufacturer must have a minimum of five (5) years of proven experience in floating pier system fabrication and installation.

C. Floating dock shall be manufactured by EZ Dock, Connect-A-Dock, ShoreMaster, or Engineer approved equal.

D. Related Sections

1. SECTION 01 33 00 – "Submittals"

1.03 REFERENCES

Floating dock, anchorages and connections shall be designed in accordance with ASCE Report No. 50 "Small Craft Harbors" dated 2000 or current edition, and the revised edition "Planning and Design Guidelines for Small Craft Harbors".

1.04 DESIGN REQUIREMENTS

The Drawings show the general arrangement of the floating docks. Details of proposed departures due to actual field conditions or other causes shall be submitted to the Engineer for review. The Contractor shall carefully examine the Drawings and shall be responsible for the proper fitting of materials and equipment as indicated without substantial alteration.

1.05 SUBMITTALS

A. Submit the following in accordance with the General and Supplementary Conditions and Section 01 33 00 – "Submittals".
1. Product data for each listed component and component accessory.
2. Detailed shop and placement drawings for the complete dock system, including railings, gangway, anchorage, mooring, and associated accessories.
3. Samples for each exposed surface finish and profile.
4. Material certificates and product test reports.
5. Warranty information.

1.06 DELIVERY, STORAGE, AND HANDLING

Deliver, store, protect, and handle products as required by the manufacturer.

1.07 WARRANTY

A. The modular dock unit warranty shall be for a minimum period of five (5) years from the date of Substantial Completion on which the completed work is turned over to and accepted by the Owner. The hardware and accessories warranty shall be for a minimum period of one (1) year from the date of substantial completion. Upon installation of the dock the Manufacturer shall provide personnel to inspect the installation and note any damage to the structure during installation.

B. The pier manufacturer shall not be responsible for damages caused by the Owner not operating and/or maintaining and/or winterizing the floating pier system in accordance with the maintenance, operating and winterizing procedures provided by the pier manufacturer in the "Operations and Maintenance Manual" approved by the Owner at the time of final acceptance.

C. The Owner shall give notice of defects, covered by this warranty, by phone in emergencies and in writing to the pier manufacturer immediately upon observance of the defects or when observed during the annual inspections.

PART 2 - PRODUCTS

2.01 FLOAT SECTIONS

A. Materials

Each dock section shall be constructed using 100% Virgin Linear Low Density Polyethylene (LLDPE), and shall include an ultraviolet inhibitor. The mean wall thickness shall be no less than 0.25 inches.

All material used in the dock structure shall provide resistance to rust and corrosion.

B. Connections

Dock section connections shall be made using male and female pockets molded into the dock structure. Pockets shall be secured using stainless steel bolts.

C. Loading

The dock sections consist of the deck surface and the float section. These are constructed as a single component. The float sections shall support a dead load plus a minimum live load of 65 lbs. per square foot.

A uniform live load of not less than 65 pounds per square foot on bridges and on the deck and structural frame of the floating dock shall be used. Minimum live load for flotation shall be 65 pounds per square foot. The dock must be designed to withstand a 400 pound concentrated live load 1’ from the end of the dock without a loss in freeboard of more than 4” at the time of acceptance, nor more than 6” at the end of 5 years. With a 200 pound load on one corner of a dock there shall be no more than a 2” difference in freeboard across the end of the dock for each 3 feet of width at the time of acceptance, nor more than 3” at the end of five years.

Dock manufacturer shall provide a dock with dead load minimum freeboards of 12”. However, actual dead load freeboard shall not vary appreciably from the freeboard above with the dock presenting a reasonably level, flat, even surface to the eye under dead load conditions. Freeboard loss shall not be more than 2.5” at the end of 5 years.

D. Railings

The dock structure shall accept guard rails which are constructed to meet standards established by the States Organization for Boating Access (SOBA) and National Uniform Building Code (NUBC). The railing shall be constructed of schedule 40 aluminum pipes, or FRP.

E. Cable Runs

Floating dock sections shall have the ability to affix instrument cables that run from their mounting locations near the end of the dock back to the instrument controllers onshore. Cables shall be run in dedicated conduit affixed to the railings.

F. Aluminum Gangway

The gangway with railings shall be constructed of marine grade aluminum and shall be installed to meet all current standards and codes. Shore end of the gangway shall rest on the ground surface. Connection to the floating dock section shall be hinged connection. The transitions at the boardwalk to gangway and the gangway to dock section shall meet all current ADA requirements. Aluminum gangway shall be 15 feet in length.

G. Anchorage System

The anchorage system for the floating dock shall be designed by the manufacturer. The anchorage system shall maintain the floating dock in the moored location, and shall protect the dock from lateral movement, flipping, and overturning.

The floating dock shall be secured with mooring cables and onshore mooring posts installed by the Contractor at the locations selected by the manufacturer. Mooring cables for the floating dock shall not cross aeration basin laterals. Bottom weight anchors may also be proposed by the manufacturer depending on basin conditions and manufacturer recommendations. The floating dock shall be supplied with stainless steel connections sized to receive the proposed mooring cables. The anchorage system shall secure the floating dock under the most severe loading conditions.

Anchorage system shall not pierce the bottom of the lagoon in any location.

PART 3 - EXECUTION

3.01 GENERAL

All floating dock products delivered to the Project shall be accompanied by certification papers showing that the products meet the applicable specifications.

3.02 INSTALLATION

A. All components specified herein shall be carefully unloaded and kept in orderly piles or stacks until installation.

B. All components specified herein shall be securely tied to avoid wind damage until permanent connections and anchorage are installed.

C. Wherever possible, parts shall be mounted so that they can be removed and replaced without interference from, injury to, or removal of other parts.

END OF SECTION

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PROCESS INTEGRATION

DIVISION 40

TABLE OF CONTENTS

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections apply to this document.

1.02 SUMMARY

A. The Contractor shall furnish and install all piping as shown on the Drawings complete with all accessories and appurtenances required for the proper performance of the work.

B. Related Sections

1. SECTION 01 33 00 – "Submittals"
2. SECTION 09 96 00 – "High Performance Coatings"
3. Division 22 – Plumbing
4. SECTION 40 05 51 – "Process Valves"

1.03 REFERENCES

All piping materials, layout, and installation shall meet the requirements of the governing local, state, and national codes and relevant AWWA Standards. Referenced codes and standards shall be the current code or standard in effect at the time proposals are received.

1.04 DESIGN REQUIREMENTS

The Drawings show the general arrangement of the piping. Details of proposed departures due to actual field conditions or other causes shall be submitted to the Engineer for review. The Contractor shall carefully examine the Drawings and shall be responsible for the proper fitting of materials and equipment in each structure as indicated without substantial alteration.

1.05 SUBMITTALS

A. Submit in accordance with the General and Supplementary Conditions and Section 01 33 00 – "Submittals."

B. Submit detailed shop and placement drawings to the Engineer for review for all piping four inches (4") in diameter or greater.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

Deliver, store, protect, and handle products as required by the manufacturer.

1.07 WARRANTY

The process piping shall be guaranteed for a period of one year from the date of substantial completion.

PART 2 - PRODUCTS

2.01 MATERIALS

Piping materials and accessories shall conform to the following specifications. Wherever pressure ratings, wall thickness, pipe class, or schedule are given herein, they shall be considered to be the minimum allowed. Piping with a higher rating, classification, or schedule shall be furnished if so called out on the Drawings.

2.02 PIPE, FITTINGS, JOINTS, COATINGS AND LININGS

The Contractor shall furnish and install all piping as shown on the Drawings. All exterior, buried piping shall be as defined in Division 33 of the Project Specifications.

All 4" diameter and larger interior or exposed piping shall be as shown on the Drawings. Fittings shall be as shown on the Drawings.

For all interior steel flanged pipe, flange connection hardware shall be galvanized or zinc plated carbon steel. Hardware shall comply with the current ASTM A307, Grade B requirements, or approved equal. Bolts and nuts shall comply with the current American Standard for Screw Head ANSI B1.1, Coarse Thread Series, Class 2 fit.

For all ductile iron pipe, flange connection hardware shall be Type 304 stainless steel. Bolts and nuts shall be semi-finished, hexagonal, complying with the dimensions for the current American Standard for Wrench Head Bolts and Nuts and Wrench Openings, ANSI B18.2, heavy series.

All nuts and bolts on stainless steel flanges shall be 316L stainless steel.

A. Ductile Iron Pipe

All 4-inch and larger wastewater piping shall be ductile iron pipe. Ductile iron pipe shall be AWWA C151 Class 53. Flanged ductile iron pipe shall be in accordance with AWWA C115. All pipe and fittings for wastewater service shall have a cement mortar lining with seal coat conforming to the requirements of AWWA C104 (ANSI A21.4).

Exteriors of all interior ductile iron pipe and fittings shall have a shop prime coat of paint in accordance with Section 09 96 00 requirements. Ductile iron pipe and fittings that are required to be coated shall be supplied without any exterior asphaltic coating. No asphaltic coating shall be permitted below coatings required by Section 09 96 00.

Flanges and fittings shall be ductile iron and meet AWWA C110/115. Casting and drilling shall be to ANSI B16.1, Class 125. Gaskets shall be Toruseal® gaskets as manufactured by American or equivalent. Gaskets for wastewater piping applications shall be neoprene.

Grooved end pipe shall meet AWWA C606 standards.

Certified reports of chemical and physical analysis of material must be supplied. Fabrication drawings shall be submitted to the Engineer for approval prior to starting fabrication of any of the material required.

B. Ductile Iron Wall and Floor Pipe

Wall pipes shall be provided for all pipes passing through concrete floors and walls. Wall pipes shall have end connections as shown on the Drawings and extend from the concrete to allow proper connection. Wall taps at flange connections are not acceptable. Integral water stop/collar

shall be provided centered within concrete floors and walls. Line and grade of wall pipes shall be verified by the Contractor prior to pouring concrete.

Ductile iron wall pipes with end configurations per the Drawings and integral waterstop collar shall be provided. Shop drawings detailing wall pipes shall be submitted to Engineer for review and approval.

Wall pipes for buried service shall have an exterior asphaltic coating in accordance with Division 33 requirements for buried pipe.

C. Steel Air System Pipe

Four inch and larger interior air system piping shall be steel. Fittings shall be as shown on the Drawings. Flanges shall be furnished for all connections to valves, blowers, wall/floor pipes, and as shown on the Drawings.

Couplings shall be furnished where shown on the Drawings and shall meet or exceed performance and quality requirements of AWWA C219.

Grooved end couplings shall be furnished as necessary and shall meet AWWA C606 standards.

Steel pipe for 24-inch nominal diameter and smaller shall be in accordance with ASTM A53, Grade B.

Steel pipe smaller than 14" shall have an inside diameter equal to the nominal pipe size. Steel pipe 10 inch diameter and smaller shall be Schedule 40. Steel pipe greater than 10 inch diameter shall have minimum wall thickness of 3/8". Fittings shall comply with AWWA C208. Flanges shall be slip-on welding type AWWA C207 Class D and ANSI, B16.1 Class 125 drilling.

Gasket material for air service shall resist degradation at air line temperatures of up to 250°F. Gaskets shall be EDPM or Engineer approved equal. Gaskets shall be full faced with 1/8" minimum thickness.

Steel pipe coatings shall resist degradation at air line temperatures of up to 250°F.

Interior of steel pipe for air service shall have a coating that resists degradation at air line temperatures of up to 250 degrees F. A two coat Tnemec Series 140 system shall be used on the interior of steel pipe and fittings. Each coat shall have a dry film thickness of 4 to 6 mils. Surface preparation shall be Near White Blast Cleaning (SSPC -SP10).

Exteriors of all steel pipe shall have a shop prime coat of Tnemec Series V69 with a dry film thickness of 4 to 6 mils. Surface preparation shall be Near White Blast Cleaning (SSPC-SP10). Contractor shall supply minimum of 48 hours notice of completion of surface preparation and allow for observation of the surface preparation by the Engineer prior to coating.

Certified reports of chemical and physical analysis of material must be supplied. Fabrication drawings shall be submitted to the Engineer for approval prior to starting fabrication of any of the material required.

D. SMALL DIAMETER PIPING (3-inch diameter and less) :

1. Pipe and Tube:

   a. Steel pipe shall conform to ASTM designation A-120. Where forming or bending of piping is required, use ASTM -53, Grade B, seamless. Galvanized steel pipe shall be Schedule 40 with screwed joints and fittings. Except at

connections to valves, equipment connections shall be made with threaded flanges, unless otherwise specified.

b. Ductile iron pipe shall meet AWWA C-151, Class 53 with cement mortar lining.

c. Copper water tube shall be ASTM B-88, Type K underground; Type L above ground. Tube shall be hard drawn seamless copper tubing. Labels shall be provided on all copper piping above ground with maximum 10-foot spacing and a minimum of 3 labels per room. Labels shall be Setmark vinyl labels by Seton or approved equal. Text for labels shall be as directed by the Owner and Engineer. Provide manufacturer's colors to the Owner for selection.

d. Brass pipe shall be ANSI/ASTM B-43, IPS 85 red brass.

e. Stainless steel pipe shall be used for all instrumentation connections. Stainless steel pipe shall be Schedule 10, Type 316 conforming to ASTM A-312, TP-316.

f. Material of small diameter air piping shall be as shown in the Drawings.

Copper air piping shall ASTM B-88, Type K underground; Type L above ground. Tube shall be hard drawn seamless copper tubing. Provide flanges where required.

Flanged stainless steel air piping shall be Schedule 10, Type 316. Transitions from stainless steel to copper shall include bolt insulating kits and insulating gaskets at the interface of stainless steel pipe flanges and copper pipe flanges and all other dissimilar materials. Stainless steel bolts shall be used on stainless steel piping.

g. Chemical piping – Chemical feed piping and fittings shall be Sch 80 PVC. Chemical feed piping shall be run in Sch. 40 PVC containment piping.

h. See Division 22 for additional small diameter pipe specifications.

2. Joints and Fittings

a. Steel pipe fittings - FS WW-P-521 Class 50 for pipe smaller than 4".

b. Copper and brass fittings shall meet ANSI/ASTM B-16.22 pressure fittings.

3. Unions and Couplings

a. Pipe Size 2" and Under - 150 psi malleable iron for threaded ferrous piping; bronze for copper or brass pipe soldered joints.

b. Pipe Size Over 2" - 150 psi forged steel slip-on flanges for ferrous piping; bronze flanges for copper or brass piping.

2.03 PIPE HANGERS AND SUPPORTS

Whether or not specifically shown on the Drawings, Contractor shall support all horizontal runs of pipe to prevent vibration, to maintain proper grading by adjustment, to provide for expansion and contraction and to be neat in appearance. Hangers and supports shall be of standard design whenever possible and best suited to service required.

Hangers are to be steel for steel or plastic pipe, cast iron for wrought iron pipe, stainless steel for stainless steel pipe, and copper plated steel for copper or brass pipe. Hangers shall be threaded to allow adjustment after installation. Hangers shall be the product of Grinnell, Elcen or Engineer approved equal.

Saddle stands shall be of an adjustable type bolted to the floor, foundation or concrete base. Install grout pad as required under stand bases. Metal piping supports shall be manufactured by Anvil Intl, Grinnell or Engineer approved equal.

Pipe supports for support at pipe flanges shall be as manufactured by Trumbull, or Engineer approved equal. Flange style pipe supports shall be of an adjustable type, bolted to the floor, foundation or concrete base. Install grout pad as required under base. Pipe supports shall be coated as described in Section 09 96 00.

Brackets shall be welded steel. Backplates shall be provided whenever possible to distribute load against the wall. Where backplates are not practical, fasteners shall not exceed the safe bearing strength of the wall. All brackets and hardware shall be stainless steel for stainless steel pipe.

Maximum spacing of hangers:

Pipe Size	Hanger Spacing
Up to 1-1/4"	6' - 0"
1-1/2" to 2"	9' - 0"
2-1/2" to 12"	10' - 0"

Maximum spacing for plastic pipe to be one half of listed spacing.

2.04 JOINTS AND ACCESSORIES

A. Grooved End Couplings

1. Ductile Iron Pipe

Grooved end couplings for ductile iron pipe shall be furnished where specifically shown on the Drawings and shall meet AWWA C606 standards. Couplings shall be Victaulic Style 31. All joints must be rigid. Gaskets shall be suitable for wastewater service and shall be Grade “S” nitrile Flushseal or Engineer approved equal. Any Victaulic couplings to be used in exterior service shall have stainless steel hardware. Couplings for ductile iron pipe shall be coated in accordance with the specification for the pipe on which they are used.

2. Steel Pipe for Air Service

Grooved end flexible couplings for steel pipe shall be furnished where specifically shown on the Drawings and shall be Victaulic Style 77 for pipe 12-inch diameter and smaller and Victaulic W77 for larger diameters. Rigid couplings shall be Victaulic Style 07 for pipe 12-inch diameter and smaller and Victaulic Style W07 for larger diameters. Gasket material shall resist degradation at air temperature up to 250 degrees F. Gaskets shall be EPDM or Engineer approved equal including replacement gaskets for existing coupling that is being relocated in the Blower Room.

B. Hydrostatic Seals

Complete hydrostatic seal assemblies shall be provided at wall and floor openings for pipe penetrations. Assemblies shall have EPDM links, glass reinforced nylon pressure plates, and Type 316 stainless steel hardware. Hydrostatic seals shall be Link-Seal as manufactured by PSI/Thunderline/Link-Seal.

C. Pipe taps

Pipe taps shall be as shown in the locations and the sizes indicated on the Drawings. All taps will be temporarily plugged at the point of fabrication. Tapping method and thread shall meet the requirements of the pipe manufacturer and shall be rated for the pressure of the pipe.

D. Sample Ports

Sample ports shall be provided as indicated on the Drawings. Sample ports shall consist of a 3/8" diameter tap, 3/8" diameter ball valve, and 3/8" diameter copper tubing gooseneck. Sample port shall be smooth nosed with no threaded fittings.

E. Pressure Gauges for Wastewater

Pressure gauges shall be provided as shown on the Drawings. Gauges shall be liquid filled and provided with 3½" dial. A snubber assembly shall be provided with each gauge to dampen pressure pulsations. Provide diaphragm with stainless steel housing and diaphragm material suitable for wastewater. Range shall be as shown on the Drawings. Gauges shall be Type 1009SW Duralife pressure gages for severe service as manufactured by Ashcroft or Engineer approved equal. Wetted materials shall be compatible with wastewater as recommended by manufacturer.

F. Flexible Pipe Connections/Vibration Isolators:

1. Steel Piping: Construct with stainless steel inner hose and braided exterior sleeve.
2. Copper Piping: Construct with bronze inner hose and braided exterior sleeve.
3. Pump Connectors: Molded neoprene elastomer construction with bias ply reinforcement cord and integral flanges at each end; 225 psi/240 deg F rated.
4. Use connectors suitable for minimum 125 psi and 450 degrees F and 200 psi WOG and 250 degrees F.
5. Flexible Couplings for Ductile Iron Pipe for Air or Water Service: Rubber tube, neoprene cover, expansion, spool type joints.
6. Manufacturers: Universal, Flexonics, Metraflex or approved equal as determined by the Engineer and Owner

PART 3 - EXECUTION

3.01 GENERAL

All pipe and fittings delivered to the Project shall be accompanied by certification papers showing that the pipe and fittings meet the applicable specifications.

All exposed piping shall be run straight and square with the structure in a neat and workmanlike manner and shall be coordinated with other work. Run piping true to line and grade.

Piping shall be hung from the building structure or laid in the ground in a manner that will allow expansion and maintain alignment.

Pipe taps for ductile iron pipe shall conform to ANSI A21.51. Steel pipe taps shall be welded half-couplings or saddle type and shall be attached in the shop.

The Contractor shall provide the necessary material and labor to make connections to existing piping when called for on the Drawings. All necessary gaskets, bolts and fittings shall be provided for this purpose.

Pipe shall be kept clean. During construction, openings in pipe shall be fitted with temporary plugs except where the pipe is actually being worked on. Piping must be clean at time of final acceptance of the work.

When piping is to connect to a piece of equipment it shall be run symmetrically, and it shall terminate so as to properly fit the fixture or piece of equipment in accordance with the fixture or Equipment Manufacturer's rough-in sheets or shop drawings.

3.02 HYDROSTATIC TEST

A. Procedure

All pressure pipe shall be tested to a pressure of 150 psig. All tests will be made by the Contractor using his own equipment, operators, and supervision, in the presence of the Engineer or his duly authorized representative. The length of the section to be tested shall be as approved by the Engineer, or as shown on the Drawings. The test shall not be against an existing valve, unless written permission is obtained from the water system operator. In no case shall a test be made against an existing valve that is found to be leaking or otherwise defective.

B. Air Removal Before Test

Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.

C. Leakage Test

A leakage test shall be conducted in the presence of the Engineer after the pressure test has been satisfactorily completed. The Contractor shall furnish the pump, pipe, connections, gages and all other necessary apparatus, and shall furnish the necessary assistance to conduct the test. The duration of the test shall be 1 hour.

No leakage shall be allowed.

The Owner shall be furnished a written report of the results of the leakage test that identifies the specific length of pipe tested, the pressure, the duration of the test, and the amount of leakage. The report shall be signed by the Contractor and the Engineer.

D. Variation from Permissible Leakage

If any test of pipe discloses leakage, the Contractor shall at his own expense locate and repair the leaks.

E. Time for Making Test

The pipe may be subject to hydrostatic pressure and inspected and tested for leakage at any convenient time after all supports and restraints have been completed.

END OF SECTION

SECTION 40 05 24
WASTEWATER SLIDE GATES AND STOP GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections apply to this document.

1.02 SUMMARY

A. Work included in this section includes furnishing and installing stop gates as shown on the Drawings. Gates shall include frames, stop plates, and appurtenances.

B. The Contractor shall furnish all labor, materials, equipment, and appurtenances as required and specified herein to provide complete gate assemblies.

C. Gate size, quantity, type, frame type, and function shall be as indicated in the "Stop Gate Schedule", found on the Drawings.

D. Fabricated stop gates shall be manufactured by Hydro Gate, Rodney Hunt Company, or Engineer approved equal. The gates shall be installed by the Contractor and tested and commissioned by the manufacturer. The Contractor shall be responsible for furnishing all gates to provide a complete, ready-to-operate facility.

1.03 QUALIFICATION REQUIREMENTS

Manufacturers requesting to be selected as an approved equal shall submit certified documentation showing compliance with these specifications for post bid review in accordance with Section 01 60 00 – "Materials and Equipment." Manufacturer shall be regularly engaged in the production of equipment of this type with a minimum of 5 years' experience.

1.04 REFERENCES

A. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. American Water Works Association (AWWA)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)

1.05 SUBMITTALS

A. Submit in accordance with Section 01 33 00.

B. Submit detailed shop and placement drawings to the Engineer for review for all gates including detailed drawings, material lists, and installation, operation, and maintenance instructions on all equipment furnished under this section.

C. Contractor's Field Reports: Certify that installed products meet or exceed specified requirements.

1.06 WARRANTY

The fabricated stop gates shall be guaranteed for a minimum period of one year from the date of substantial completion.

PART 2 - PRODUCTS

2.01 STOP GATES

A. General: Stop gates shall be of sizes listed in the "Gate Schedule" and shall be either embedded cast-in-place frames (guides) or surface mounted as detailed in Drawings. The closure shall be of flush bottom design with neoprene bottom seal.

B. Slide and Frame: Hand pull gate frames shall be fabricated from aluminum, Bo202 or B303 Alloy 6061-76.

The frame shall be special extruded aluminum shape with securely attached UHMWPE liners with lip sealing action at sides of opening. The frame design shall be suitable for embedment in concrete or for anchor bolt mounting on a grout pad.

The frame lower member shall contain a securely retained neoprene T section seal for complete closure against the lower edge of the slide.

The slide shall be minimum ¼" thick aluminum plate with one or two handles or hand holes. Edges of holes or handles shall be rounded for comfortable grip.

The slide shall be reinforced as necessary to limit deflection under water head to L/360.

C. Seal: Seal shall be neoprene, ASTM D2000 grade 1, BE625.

D. Guides: Ultra High Molecular Weight (UHMW) Polymer, ASTM D40200.

Guide liners shall be UHMW polymer of special molded shape to prevent metal to metal contact. They shall be securely fastened in the frame groove and shall have lip action sealing.

2.02 DOWNWARD OPENING WEIR GATES

A. Gate frame shall be flat back, embedded or channel mount as shown in the "Gate Schedule." Spigot-back frames are not acceptable. The frame shall be an integral unit of extrusions and structural shapes, rigidly assembled to form the waterway openings. Holes shall be provided for mounting on anchor bolts. The primary slot of the frame extrusion shall contain polymer guide liner retained in grooves, to prevent metal-to-metal contact between slide and frame.

B. Materials:
   a. Slide, Frame, Reinforcing Members, and Self-contained Yoke: Stainless Steel, ASTM A240/A240M, Type 304L.
   b. Stems and Retainer Bars: Stainless Steel, ASTM A276, Type 304.
   c. Side Seal: Ultra High Molecular Weight (UHMW) Polymer, ASTM D40200.
   d. Top Wedges: Stainless Stel, ASTM A351-CF8M, Type 304.
   e. Fasteners: Stainless Steel, ASTM F593/F594, Alloy Group 1 or 2 (Type 304).
   f. Invert seals and compression load pad: Neoprene, ASTM D2000 grade 1, BE625.
   g. Pedestals, Wall Brackets, Stem Guide Brackets: Stainless Steel, ASTM A276, Type 304.
   h. Stem Guide Bushings: Ultra High Molecular Weight (UHMW) Polymer, ASTM D40200.

C. Gate slide shall conform to the safety factors stated under "General", but shall, in no case, be less than ¼ inch thick. Deflection under full head shall be limited to 1/720 of the span, or 1/16 inch, whichever is less. The stem connector clips or stem block pocket shall be welded to the slide.

D. Flush Bottom: Slide gates shall incorporate a flush-bottom seal that is attached to the bottom frame invert member. The seal shall be of the materials shown in "Materials".

E. Seals: UHMW seals shall be provided as specified in the "Gate Schedule." Seals shall be securely fastened to the frame with formed stainless steel retainers and shall be replaceable and adjustable without removing the gate from the installed position. A compression load pad shall be set behind the UHMW seal to allow for a self-adjusting seal system. The face of the UHMW guide that is in contact with the cover bar shall have a machined or extruded groove, in order to create a raised surface on each side, to allow for secondary adjustment of the seal clamp force.

F. Yoke: Self-contained gates shall be provided with a yoke designed to withstand the thrust of the operator. Yoke deflection shall not exceed 1/360 of the gate width or a maximum of ¼ inch, whichever is less at maximum operating load. The yoke head channels shall be welded to the gate frame. The channels shall be sufficiently spaced to allow removal of the gate slide.

G. The operating stem shall be of a size to safely withstand, without buckling or permanent distortion, the stresses induced by normal operating forces. In addition, the stem shall be designed to transmit in compression at least 2 times the rated output of the floor stand or bench stand with a 40-pound effort on the crank or handwheel. The threaded portion of the stem will have cold rolled threads of the double lead Acme type. Stainless Steel couplings, threaded and keyed to the stems, will join stems of more than one section. All threaded and keyed couplings of the same size will be interchangeable. Manually operated, rising stem type gates will be provided with an adjustable stop collar on the stem to prevent over-opening of the gate.

H. Manually operated weir gate shall be geared crank type. Lifts shall operate the gate with a maximum pull of 40 lb on the handwheel or crank. Handwheel or crank shall be located approximately 36 in. above grating or walkway. All lifts shall have thrust bearings, bronze lift nuts, and a bronze stop nut to limit the downward travel of the stem and slide. All geared lifts shall have cast or ductile iron housings and cast or fabricated pedestals. All lifts shall be rising stem type if possible. Lifts shall be grease lubricated and regreasable through grease zerks. Oil bath lifts are not acceptable.

I. A clear, polycarbonate plastic stem cover and indicator shall be provided on each slide gate operator. Stem indication shall be provided to denote gate level. A cast aluminum adaptor shall be used to mount the cover to the lift or operator. The covers shall be capped, vented, and of sufficient length to allow full travel of the gate.

2.03 FINISHES

A. The gate manufacturer shall be responsible for shop prime and finish painting of all gates and appurtenances supplied under this contract. All coatings shall conform to VOC Emission Regulations in effect at the manufacturing location and at the project site to allow touch up or recoating to be performed with the same products.

B. Submerged surfaces shall be cleaned to SSPC SP10, dry, and grease-free prior to painting in conformance with the paint manufacturer's instructions. Non-submerged surfaces shall be cleaned to SSPC SP6.

C. Stainless steel gates and accessories shall not be painted.

2.04 SHOP TESTING

The completely assembled gate shall be shop inspected for proper seating. Seals shall be adjusted to exclude a 0.004 inch thickness gauge between the seating surfaces. The slide gate shall be shop-operated from the fully open to the fully closed position to verify the assembly is workable.

PART 3 - EXECUTION

3.01 INSTALLATION

All gates shall be installed in full conformity with the instructions and recommendations of the equipment manufacturer. Gate installation shall be witnessed and approved by an authorized slide gate representative prior to concrete encasement. Installation shall be plumb and coplanar.

The authorized gate representative shall be on site during the field tests to assure the following items:

- No damage was done to the gate unit during shipment and installation.
- The gate unit is properly installed.
- The gate unit is in proper alignment.

Operating Instructions: The Contractor shall furnish, upon completion of the equipment installation and before initial operation, three (3) bound sets of complete operating instructions for all equipment furnished and installed under this contract.

Lubrication and Tools: All equipment shall have facilities for lubrication conveniently located. The Contractor shall provide lubrication equipment that will be necessary for proper maintenance. The Contractor shall also provide maintenance instructions and one year's supply of recommended lubricants for each item of equipment properly labeled.

The Contractor shall furnish any special tools necessary for proper maintenance and adjustment of the equipment.

3.02 FIELD QUALITY CONTROL

A. Field testing shall be performed by a manufacturer authorized gate representative after installation of the equipment. The field testing shall demonstrate the following:

1. The equipment has been properly installed in accordance with manufacturer’s instructions and recommendations.

2. The equipment has been installed in the specified location and orientation or as shown on the Contract Drawings.

3. The equipment has been aligned.

4. There are no mechanical defects in any of the parts.

5. The slide gates shall undergo a leakage test following installation. The leakage test shall be in accordance with the latest version of AWWA.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections apply to this document.

1.02 SUMMARY

A. Work included in this section includes furnishing and installing process valves as shown on the Drawings complete with all accessories and appurtenances required for the proper performance of the work.

B. The Drawings indicate the general location of the valves and the intended service, type, and valve size. The Contractor shall be responsible for furnishing all valves to provide a complete, ready-to-operate facility.

C. Valves 4 inch diameter and larger have been assigned letters or numbers in the valve schedule shown on the Drawings. Valve size, type, class, function and type of control and quantity have been shown on the valve schedule.

D. Existing valves are designated by letters. One hundred series numbers designate valves for wastewater and include valves to be provided and existing vales that have been renamed. Two hundred series numbers designate valves for air and include valves to be provided and existing valves that have been renamed.

E. Related Sections:
1. SECTION 01 33 00 – “Submittals”
2. SECTION 40 05 13 – “Process Piping”

1.03 REFERENCES

All valve materials and installation shall meet the requirements of the governing local, state, and national codes. Referenced codes and standards shall be the current code or standard in effect at the time proposals are received.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping to protect internal parts against rust and corrosion, and to protect threads, flange faces, grooves, and weld ends. Set globe valves closed to prevent rattling. Set ball and plug valves open to minimize exposure of functional surfaces. Set butterfly valves closed or slightly open, and block check valves in either open or closed position.

B. Maintain valve end protection during storage. Store indoors and maintain valve temperature higher than ambient dew-point temperatures. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use a sling to handle large valves. Rig to avoid damaged parts. Do not use handwheels and stems as lifting or rigging point.

1.05 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – "Submittals."

B. Submit detailed shop and placement drawings to the Engineer for review for all valves including detailed drawings, material lists, and installation, operation, and maintenance instructions on all equipment furnished under this section.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 WARRANTY

The process valves shall be guaranteed for a minimum period of one year from the date of substantial completion.

PART 2 - PRODUCTS

2.01 MATERIALS

Materials used in the production of valves shall be of the best quality used in normal industrial practice for the service intended. Material shall be free of all defects and imperfections that could affect the serviceability of the product. The materials and types of valve construction specified below are for normal duty applications.

Valves shall be the standard product of a manufacturer regularly engaged in the production of equipment of this nature.

2.02 EQUIPMENT

A. Eccentric Plug Valves:

1. General:

Contractor shall furnish and install eccentric plug valves as shown on the Drawings.

Eccentric plug valves shall be rated at 175 psi on sizes ½ - 12" and 150 psi for 14 - 72". Every valve shall be given a hydrostatic and seat test with certified test results provided to the Engineer prior to shipment.

Plug valves noted on the valve schedule as "direct bury" shall be suitable for buried service and shall have end connections as noted in the valve schedule.

Operators shall be considered an integral part of the valve and shall be supplied by the valve manufacturer. The Contractor shall use Series PEC valves and operators as manufactured by DeZurik as base bid.

2. Valve:

Valve shall be non-lubricated eccentric type with resilient faced plugs. Valve bodies shall be of ASTM A126 Class B cast iron. Flanged ends shall be faced and drilled per ANSI B16.1 standard for cast iron flanges. Where called for in the drawings valve ends shall be mechanical joint for buried service.

Bodies shall be furnished with a 1/8" welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats and bolted-in seats shall not be acceptable.

Plugs shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between

the plug face and body seat with the plug in the closed position shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene/Chloroprene or Hycar suitable for use with wastewater. Valve interior coating shall be coal tar epoxy compatible with the wastewater.

Valves shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated Type 316 ASTM A743 Grade CF-8M steel or AISI Type 317L stainless steel. Non-metallic bearings shall not be acceptable. In valves larger than 36", the upper and lower plug journals shall be fitted with ASTM A-240 type 316 stainless sleeves with bearings of ASTM B30, Alloy C95400 aluminum bronze. Non-metallic bearings shall not be acceptable.

Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing o-ring seals or non-adjustable packing shall not be acceptable.

Grit excluders made of PTFE shall be provided to prevent entry of grit and solids into the bearing areas.

3. Operators

Manual Operators

Manual valves shall be provided with operators indicated in the Valve Schedule. Valves 4-inch and smaller shall be provided with a lever operator. All other manual valves shall be provided with a handwheel operator unless an alternate manual operator is indicated in the Valve Schedule.

Valves shall open left or counterclockwise. All gearing shall be enclosed in a cast-iron housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated.

Electric Operators

Electric operator shall be Rotork IQTM actuator or Engineer approved equal and shall be sized and supplied by the valve manufacturer. Valve supplier shall verify actuator torque requirements and provide all necessary accessories to couple the actuator to the valve stem.

Actuator shall include an electric motor, reduction gearing, reversing starter with local controls and indication, turns and torque limitation with electronic logic controls and monitoring facilities housed in a double-sealed watertight enclosure.

Actuator shall modulate based on a 4-20 mA signal from the existing control system and shall provide a position indication signal back to the control system. Existing signal wires shall be reused, or replaced as necessary for proper operation.

IQTM actuators shall be suitable for operation with 1-Phase 60 Hz power, 120-240 Volts.

B. Swing Check Valves

Contractor shall furnish and install weighted swing check valves as shown on the Drawings.

Check valves shall be designed and manufactured in conformance with AWWA C-508 standards. The flow area shall be greater to or equal to the nominal valve size. Valves shall have a cast or ductile iron body with rubber faced disc. Valves shall be flanged in accordance with ANSI B 16.1, Class 125. The body seat shall be replaceable without special tools. The disc to shaft pin connection shall hold the disc firmly in place during operation. The pivot shaft shall extend through both sides of the body, and shall be of stainless steel with bronze bushings. Valves shall

be equipped with an adjustable weight. Valves shall be constructed to permit top entry for complete removal of internal components without removing the valve from the line. Valves shall be APCO Swing Check Valves or Kennedy Swing Check Valves as base bid.

C. Rubber Flapper Swing Check Valves – RAS Pump Discharge & RAS Interconnect

Contractor shall furnish and install rubber flapper swing check valves as shown on the Drawings.

Check valves shall be designed, manufactured, and tested in conformance with AWWA C-508 standards. Valve body shall be ductile iron ASTM A536 Grade 65-45-12. Body seat shall be on a 45 degree angle to the centerline of the pipe, permitting horizontal or vertical installation. Valve shall be rated to 175 psi cold working pressure.

Rubber flapper shall have a steel disc encapsulated with Chloroprene (CR). The flapper shall be captured between the body and valve cover to permit the disc to flex open and closed. An integral O-ring shall be molded onto the face of the rubber flapper for positive sealing.

Hinge section of the rubber flapper shall be designed to accelerate closing due to an elastic spring effect. High-strength fabric shall be integrally molded in the rubber over the disc and bar to form a flexible joint.

Valve shall be provided with a bottom mounted hold-open device to permit the Operator to force the flapper open for maintenance or flushing. Valves shall be APCO Rubber Flapper Swing Check Valves, or Engineer approved equal.

D. Resilient Seat Butterfly Valves – Air Application

Resilient seated butterfly valves shall be model BOS as manufactured by DeZURIK as base bid.

Butterfly valves in sizes 1½"-24" shall have on-center disc, and shall be of the lugged body style. All valves shall be suitable for use with ANSI class 125 or 150 flanges. Face-to-face dimensions are in accordance with MSS-67 and API 609 (category A).

Pressure ratings shall be bi-directional drip-tight shutoff at pressures to 150 psi with a 316 stainless steel disc.

Testing shall be per MSS-SP67 and API 609 requirements. Valves shall be proof-of-design tested per AWWA C504 standards – 10,000 cycles for 1½"-20" and 5,000 cycles for 24".

Bodies shall be ductile iron. Lugged body valves shall provide tight shutoff up to the full valve rating on dead end and isolation service without the use of downstream flanges.

Elastomer seats shall fully line the valve body and be permanently bonded to a replaceable cartridge. Seats shall be EPDM. Seats shall have integral flange seals so flange gaskets are not required.

Shafts shall be one-piece 416 stainless steel, Shaft shall be firmly attached to the disc utilizing solid pins. Multiple shaft seals shall be provided to prevent leakage.

Three shaft bearings made of heavy-duty fiberglass reinforced PTFE shall be provided to ensure smooth, reliable valve operation.

Lever operators shall provide automatic, positive latching in the open, closed and eight intermediate positions.

Gear actuators shall be provided on valves 8" and larger. Actuators shall have cast iron weatherproof construction, and shall have adjustable open and closed position stops.

Two Year Warranty shall be provided for all valves and actuators.

E. Double Door Check Valves – Air Application

A double door check valve for air service shall be provided and installed for Blower 1. Valve shall have a ductile iron or cast iron wafer body with a 316 stainless steel or aluminum door. Seat material shall be EPDM or silicone.

Valve shall be suitable for use with air at operating pressures of 5 to 15 psig. Double door check valve shall be Dezurik-Apco CDD900T, Hoffman Lamson Wafer Style check valve, or Engineer approved equal.

F. Flanged End Inline Duckbill Elastomeric Check Valves – Grit Pump Discharge

Contractor shall furnish and install a flanged end inline duckbill elastomeric check valve at the grit pump discharge.

Valves shall be Series 39 check valve as manufactured by Tideflex Tecnhologies, Carnegi, PA 15106, or Engineer approved equal.

The bill slit of the duckbill valve shall be at least 1.57 times the nominal pipe diameter

Valve body shall be a two piece split configuration of cast iron. Rubber sheet gaskets, cut to match the profile of the body halves shall seal the two halves. The flanges shall be drilled to mate with ANSI B16.1, Class 125/ ANSI B16.5 Class 150 flanges, and port areas shall be 100% of the mating pipe port area. Valve body shall be drilled and tapped for a supplied clean out plug on the top of the body and flushing connections on the bottom of the body supplied with plugs.

The check sleeve is to be of the fabricated elastomer “duckbill” type. The sleeve shall be one piece EPDM rubber construction with fabric reinforcement. The inlet port shall have an integral flange, drilled to be retained by the flange bolts and acting as the gasket between pipe and valve. The flange will be drilled to ANSI B16.1, Class 125/ ANSI B16.5 Class 150 standards, and the inlet port area shall be 100% of the mating pipe port area. The port area shall contour down to a duckbill, which shall allow passage of flow in one direction while preventing reverse flow.

Manufacturer must have available flow test data from an accredited hydraulics laboratory to confirm pressure drop data. Company name and location shall be cast onto the valve body.

Manufacturer’s authorized representative shall be available for customer service during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.

Manufacturer shall also make customer service available directly from the factory in addition to authorized representatives for assistance during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.

G. Duckbill Check Valves

Contractor shall furnish and install a duckbill check valve on the drain line to the Polishing Pond Pump Station wet well as shown on the Drawings.

Duckbill check valves shall be of the flow operated check type with a slip-on connection. The valve shall be designed to slip over the outside diameter of the pipe and attach by means of stainless steel clamps. The port area shall contour down to a duckbill, which shall allow passage of flow in one direction while preventing reverse flow. The valve shall be one piece rubber

construction with nylon reinforcement. The duckbill shall be offset so that the bottom line of the valve is flat, keeping the invert of the valve parallel with the invert of the pipe. Duckbill check valves shall be Tideflex Series TF-1 or Engineer approved equal.

H. Wastewater Air Release Valves

Air release valves shall operate under pressure and allow entrapped air and gases to escape from the pipeline. Valves shall be manufactured in compliance with ANSI/AWWA C512.

The valve shall operate through a compound lever system and shall have an appropriately sized orifice with a stainless steel sealing face and an adjustable Buna-N rubber valve. The valve shall have an NPT threaded inlet connection, cast iron body, and stainless steel float and trim. The valves shall be supplied with backflushing attachments so that the interior body can be flushed periodically for proper operation. The valve shall be of short body design with overall height including isolation valve and backflushing attachment not to exceed 17 ½".

Valves shall be sized based on typical flow rates. The valve shall have a 1/8" orifice and shall be capable of operating at 2 to 5 PSIG and passing 2 SCFM of air. The air release valves shall be 2" Crispin Model S20SB, Type P, Pressure Sewer Valve with ½" NPT outlet, as manufactured by Crispin Multiplex Manufacturing Co. or Engineer approved equal.

I. Wastewater Combination Air Valves

Contractor shall furnish and install combination air valves in the Polishing Pond Pump Station valve chamber and Control Structure F as shown on the Drawings.

Combination air release/vacuum relief valve shall function to automatically discharge air and gas from a filling system, admit air to relieve vacuum during pipe draining, continually release air and gas in a pressurized system, and discharge/admit air and gas at a high rate during surge events. Valves shall be manufactured in compliance with ANSI/AWWA C512 for wastewater service.

The valve shall have a threaded inlet connection, stainless steel body, stainless steel shaft, stainless steel float and trim, and NBR seat. The valve shall be supplied with backflushing attachments so that the interior body can be flushed periodically for proper operation. The valve shall also be provided with a dual acting throttling device on the outlet.

Valves shall be sized based on typical flow rates. The valve shall have a 5/16" orifice and shall be capable of operating at 40 to 100 PSIG and passing 13 SCFM of air. Air combination valve shall be 2 inch APCO ASU, SCAV, R516 or Engineer approved equal.

2.03 ACCESSORIES

A. Valves shall be equipped with accessories as noted or as required for a workable, complete installation. Operating wrenches, levers, extension stems, guides, floor boxes, or valve boxes shall be furnished and installed. Operators shall be installed, adjusted, and tested for operation by the valve manufacturer.

B. Valve Tags. All process valves shall be provided with a valve tag. The tag shall indicate the valve number as provided on the schedule. The tag shall be fabricated of stainless steel with the letters etched clearly on it. The tag shall be attached to the valve with a metal cable/chain.

PART 3 - EXECUTION

3.01 EXAMINATION

Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

A. Examine valve interior for cleanliness, freedom from foreign material, and corrosion. Remove special packing materials.

B. Operate valve from fully open to fully closed positions. Examine guides and seats made accessible by valve operation.

C. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition, and freedom from defects or damage.

D. Do not attempt to repair defective valves. Replace with new valves.

3.02 INSTALLATION & RESTRAINT

Install valves as indicated, according to manufacturer's written instructions. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

Provide separate support for valves where necessary.

3.03 INSPECTION AND TESTS

All valves shall be tested along with the process pipe in accordance with Section 40 05 13 – "Process Piping." All valves with surface and visible defects shall be removed and replaced with new valves prior to final acceptance. All valves shall be operated by the Contractor in the presence of the Engineer.

END OF SECTION

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SECTION 40 91 00
PROCESS INSTRUMENTATION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The work of this section includes furnishing and installing all (process) instrumentation, and controls for improvements to the Biopure Treatment Facility located in Hart, Michigan.

1.02 RELATED SECTIONS:

A. Section 26 05 00 - Electrical General Provisions

1.03 REFERENCES:

A. Applicable Standards and Codes:
1. American National Standards Institute (ANSI).
2. American Society for Testing & Materials (ASTM).
3. Institute of Electrical & Electronic Engineers (IEEE).
4. Instrument Society of America (ISA).
5. National Electrical Code (NEC).
6. National Electrical Contractors "Standard of Installation" (NECA).
7. National Electrical Manufacturers Association (NEMA).
8. National Board of Fire Underwriters (NBFU).
9. National Fire Protection Association (NFPA).
10. Underwriters' Laboratories, Inc. (UL).

1.04 GENERAL REQUIREMENTS:

A. Provide all components necessary. Some components (i.e., power supplies, interposing relays, signal converters, intrinsically safe relays and barriers, etc.) and mounting hardware may not be specifically itemized.

B. Provide components which are compatible with process equipment.

C. Functionally similar components shall be products of a single manufacturer.

1.05 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Itemized Listings:
1. Description of deviations from the requirements of this section.
2. Re-submittals shall contain response(s) to each comment made by Engineer.

C. Shop Drawings:
1. General: Shop drawing submittal material shall be project specific.
2. Provide shop drawings and product data for all process control and instrumentation equipment, to include:
a. Manufacturer's name and model number.
b. Equipment description, type, scale or range.
c. Product data sheet(s).
d. Standard drawings and illustrations.
e. Dimensions.
f. Materials of construction.
g. Details of construction and installation.
h. Project specific wiring diagrams, clearly indicating all field wiring requirements.

i. Accessories list.

D. Operation and Maintenance Manuals:
1. At project substantial completion provide 3 copies of operation and maintenance manuals bound in a spiral hard cover binder containing detailed Record Drawings as provided above and renewal parts information including source location and maintenance recommendations and the following:
a. Equipment function, normal operating characteristics and limiting conditions.
b. Assembly, installation, alignment, adjustment and checking instructions.
c. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions.
d. Maintenance instructions.
e. Guide to "troubleshooting."
f. Parts lists and predicated life of parts subject to maintenance replacement.
g. Test data and performance curves.
h. Field calibration/start-up sheets.

1.06 QUALITY ASSURANCE:

A. Manufacturer's Services: Provide manufacturer's field service as specified herein. Submit field service calibration/start-up checklist for each instrument.

B. All materials, installation and testing shall be in accordance with ISA Standards and Recommended Practice.

C. Contractor shall conduct field investigations as required to verify existing conditions, instrument ranges/calibration and signal types.

1.07 DELIVERY, STORAGE AND HANDLING:

A. All instrumentation equipment shall be stored and protected from dampness and humidity during construction.

1.08 MAINTENANCE:

A. Touch up or refinish damaged paint.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Provide all mounting hardware required.

B. All mounting hardware shall be of the following corrosion resistant material. Coordinate mounting material with surrounding environment:
1. PVC.
2. Stainless steel.
3. FRP.

C. Provide sufficient length of sensor to transmitter cable for each field device.

D. Provide unions, bulkhead fittings, isolation valves, etc.

E. Provide instruments rated for environment.

F. Field verify Manufacturer's cable lengths required prior to shop drawing submittal.

G. Existing instruments that are relocated or modified shall be recalibrated.

H. Tagging: Equip all instruments with a permanently attached, stamped or engraved identification tag. The tags shall include the device name, Engineer's tag identification, and manufacturer's tag identification if different from Engineer's.

I. Finish: Finish on the instruments and accessories shall provide protection against corrosion by the elements in the environment in which they are to be installed.

J. Temperature Rating: Instruments shall be suitable for the temperature in which they are to be exposed. Therefore, instruments located outdoors or in unheated spaces shall be suitable for -20°F to 120°F. Instruments exposed to direct sunlight (without sunshield) shall be suitable for temperatures up to 140°F.

K. Provide configuration software and cables or hand-held device(s) for any instrument which cannot be fully programmed via keypad/interface which is integral to device.

2.02 ELECTROMAGNETIC FLOW METERS (FE/FIT):

A. New flow meter sensors and remote transmitters will be furnished, installed, calibrated and configured by the contractor.

B. Meters:

1. FE/FIT-1 (Rapid Infiltration Beds Meter Chamber): 6" flow meter with remote transmitter shall be located in the new Meter Chamber as indicated on the plans. Flow meter shall indicate and totalize flow in forward direction. Flow indication shall be in gallons per minute with totalized flow units of thousand gallons per day. Totalized flow shall also be displayed at the transmitter. Normal operation will be between 100 and 1,000 gallons per minute with an operation range of 0 to 1,500 gallons per minute.
2. FE/FIT-4 (RAS1 Discharge): 6" flow meter with remote transmitter shall be located in the Treatment Building Blower Room as indicated on the plans. Flow meter shall indicate and totalize flow in forward direction. Flow indication shall be in gallons per minute with totalized flow units of thousand gallons per day. Totalized flow shall also be displayed at the transmitter. Normal operation will be between 100 and 800 gallons per minute with an operation range of 0 to 1,000 gallons per minute.
3. FE/FIT-5 (RAS2 Discharge): 6" flow meter with remote transmitter shall be located in the Treatment Building Blower Room as indicated on the plans. Flow meter shall indicate and totalize flow in forward direction. Flow indication shall be in gallons per minute with totalized flow units of thousand gallons per day. Totalized flow shall also be displayed at the transmitter. Normal operation will be between 100 and 800 gallons per minute with an operation range of 0 to 1,000 gallons per minute.
4. FE/FIT-6 (RAS3 Discharge): 6" flow meter with remote transmitter shall be located in the Treatment Building Blower Room as indicated on the plans. Flow meter shall indicate and totalize flow in forward direction. Flow indication shall be in gallons per minute with totalized flow units of thousand gallons per day. Totalized flow shall also be displayed at the transmitter. Normal operation will be between 100 and 800 gallons per minute with an operation range of 0 to 1,000 gallons per minute.
5. FE/FIT-7 (RAS4/RAS5 Discharge): 8" flow meter with remote transmitter shall be located in the Treatment Building North Clarifier Room as indicated on the plans. Flow meter shall indicate and totalize flow in forward direction. Flow

indication shall be in gallons per minute with totalized flow units of thousand gallons per day. Totalized flow shall also be displayed at the transmitter. Normal operation will be between 100 and 1,000 gallons per minute with an operation range of 0 to 1,500 gallons per minute.

A. Electromagnetic flow meters shall conform to the following Specification unless otherwise noted:
   1. Flow tubes shall be constructed with the flow transmitter remotely mounted.
   2. Flow tube size(s): The flow tube size shall conform to the line size(s) as noted in B above.
   3. Flow tube shall be 304 stainless steel. Process connection shall be stainless steel raised face flanges rated for ANSI Class 150 for meter sizes smaller than 10" and carbon steel raised face flanges rated for ANSI Class 150 for meter sizes 10" and larger, with a hard rubber liner. Verify piping drawings to confirm connection type. Flow sensor housing shall have protection rating to meet IP68 continuous submergence standard.
   4. Flow tube electrodes shall be Hastelloy C, bullet-nose style electrode with stainless steel ground rings upstream and downstream. Grounding Electrodes are not acceptable.
   5. Output: A programmable flow meter shall convert the flow signal of the primary element into an appropriate linear 4-20mA signal. The output shall be isolated linear and be capable of driving 0-750 ohms. The electronics shall employ an onboard self-diagnostics package. Hart Protocol compatible.
   6. Relay Contact Scaled Pulse Output: Provide dry-contact scaled pulse output option. Relay contact: Max. 30V, max. 250mA.
   7. Unit shall have nonvolatile memory integral with transmitter to save calibration settings and other information necessary to properly operate.
   8. Sampling frequency up to 100 Hz with inherent levels of noise.
   9. Empty pipe detection.
   10. Reverse flow detection with discrete output to indicate reverse flow through the pipe.
   11. Adjustments: The field adjustments required shall be zero and span, and they shall be adjustable without the use of special test equipment. These adjustments shall allow adjustment of signal damping and low flow cutoff to calibrate the equipment.
   12. Performance Accuracy: The electronics shall employ all digital electronics to insure an accuracy of measurement to a minimum of ±0.3% of rate 1.0 to 30 feet per second. This accuracy capability will range from ±0.1% to full scale of flow rate. Adjustable flow range shall meet or exceed 75:1 turndown.
   13. Sensor Enclosure Rating: Sensor shall be rated to meet IP68 continuous submersion under pressure standard and be rated for a Class I, Division 2 hazardous location.
   14. Grounding: Provide compatible grounding rings and connections to properly ground the flow tube per manufactures specifications.
   15. Transmitter Enclosure Rating: Die-cast aluminum transmitter enclosure shall be rated NEMA 4.
   16. Two-line integral illuminated digital flow display capable of displaying flow rate and totalized flow simultaneously. Meter shall be capable of bi-directional flow with contact outputs as forward or reverse indication.
   17. Meter shall operate on a 120VAC (60 hz) power source nominally.
   18. Total meter construction shall comply with ISO 9000 Standards and be FM approved. A computer printout of actual hydraulic calibration traceable to NIST Standards shall be provided.
   19. Transmitter shall be interchangeable without effect of meter accuracy or the need for recalibration for all meter sizes.
   20. Provide required lengths of Manufacturer's cable for remote mounted indicators.

21. Manufacturers: Base bid manufacturer is Rosemount Model 8750W with Remote Transmitter.
    a. Other manufacturers' flow meter may be submitted as an alternate to the base bid equipment. Manufacturers that submit an alternate bid are required to meet all specifications listed herein of this section and related sections. If there are deviations from this specification, the manufacturer must provide a written request to the Engineer for approval prior to submission of their bid. The Contractor is responsible for any engineering or design changes associated with approval of an alternate flow meter.
22. Provide a two-year warranty as standard.

2.03 PRESSURE TRANSMITTERS (PIT):

A. Microprocessor based smart transmitter.

B. Pressure: Gauge, process air.

C. Display: Integral LCD / LOI.

D. Material:
   1. Stainless steel wetted parts and diaphragm.
   2. Teflon O-rings.
   3. Silicone fill fluid.
   4. Provide stainless steel mounting bracket and hardware, where applicable.
   5. Epoxy covered aluminum housing, non-explosion proof.

E. Process Connection: 1/2” NPT.

F. Conduit Entry: 1/2" NPT.

G. Accuracy: 0.075% of span with 5-year stability.

H. Rangeability: 30:1.

I. Operating Range: 0 to 15 psig.

J. Sensor temperature range: 0 to 200 F.

K. Output: 4-20 mAdc / HART.

L. Power: Loop powered.

M. Warranty: 5 year.

N. Manufacturers: Rosemount or Engineer approved equal by ABB, Siemens.

O. Accessories:
   1. Drain and vent valve.
   2. 2-Valve Block and Bleed Manifold, for process air applications.
   3. Provide 316 stainless steel mounting hardware, where applicable.

2.04 DISSOLVED OXYGEN/TOTAL SUSPENDED SOLIDS PROBES AND ANALYZER (AE/AIT-103):

A. Dissolved Oxygen Probes (DO):
1. The probe shall be of continuous-reading probe, replaceable sensor cap, and 33 - foot integral cable with "quick-connect" connector.
2. The sensor is made of polybutyl methacrolate.
3. Measurement range: 0 to 20mg/L.
4. Resolution: 0.01 mg/L.
5. Accuracy:
   a. Less than 5 ppm: ± 0.1 ppm.
   b. Greater than 5 ppm: ± 0.2 ppm.
6. The probe is made of CPVC and 316 stainless steel.
7. The probe is entirely corrosion-resistant and fully immersible.
8. The probe does not require sample conditioning or electrolyte solutions.
9. The probe interface to the controller is MODBUS®..
10. The operation of the probe is not affected by: H2S, pH, K+, Na+, Mg2+, Ca2+, NH4 +, Al3+, Pb2+, Cd2+, Zn2+, Cr (total), Fe2+, Fe3+, Mn2+, Cu2+, Ni2+, Co2+, CN–, NO3–, SO4 2–, S2–, PO4 3–, Cl–, Anion Active Tensides, Crude Oils, Cl2 < 4 ppm.
11. Provide handrail mounting assembly and sensor float kit.
12. Probes shall be suitable for installation is Class I, Division 2 hazardous location.
13. Manufacturer: Hach, model LDO™ Dissolved Oxygen Probe, no equal.

B. Total Suspended Solids Probes (TSS):
1. The probe shall be a suspended solids sensor for monitoring water and sludge concentration values, factory calibrated needing no calibration prior to use and 33 - foot integral cable with "quick-connect" connector.
2. The sensor is made of stainless steel or PVC.
3. Material:
   a. Optics carrier and sleeve: Stainless steel.
   b. Wiper arm: Silicone
   c. Wiper Blade: Stainless steel.
   d. Wier Shaft: Stainless steel.
   e. Threaded Cable Fitting: Stainless steel.
4. Suspended Solids Units of Measure,: User Selectable g/L, mg/L, ppm, or % solids.
5. Measurement range TSS-Content: 0.001 mg/l to 50 g/l.
6. Accuracy: Suspended solids: Less than 5% of reading.
7. The probe is made of CPVC and 316 stainless steel.
8. The probe is entirely corrosion-resistant and capable of immersion in tank.
9. The probe interface to the controller is MODBUS®..
10. Provide stainless steel pole mount kit for immersion mounting in open tank
11. Probes shall be suitable for installation is Class I, Division 2 hazardous location.
12. Manufacturer: Hach, model Solitax™ ts-line sc Suspended Solids Sensor for immersion in open tanks, no equal.

C. Analyzer:
1. Provide one dual channel analyzer to support two (2) sensors, dissolved oxygen (DO) and total suspended solids (TSS).
2. The analyzer shall be a microprocessor-based and is housed in a NEMA 4X enclosure, rated IP66.
3. The analyzer shall operate using 120 volt AC, 50/60 Hz power.
4. The analyzer shall display dissolved oxygen measurement, total suspended solids, temperature, and menu-driven operation system.
5. The analyzer shall be equipped with temperature compensation.
6. The analyzer has a data logger with RS-232 capability.

7. Four SPDT relays (Form C), user-configurable contacts rated 100 to 230 Vac, 5 Amp resistive maximum.
8. Two analog 4-20 mA outputs and/or optional selectable digital I/O, maximum impedance 500 Ohms.
9. Alarms
    a. Low alarm point
    b. Low alarm point deadband
    c. High alarm point
    d. High alarm point deadband
    e. Off delay
    f. On delay
10. Controls
    a. Linear
    b. Bi-Linear
    c. Logarithmic
    d. PID
11. Communication
    a. RS-485 (MODBUS): Advanced communications/networking with PLC or SCADA system directly from analyzer.
12. All user settings of the controller are retained for 10 years in flash memory.
13. Accessories:
    a. Stainless steel mounting hardware. The sensor shall be mounted per the manufacturer's recommendations. All required mounting brackets and connecting cables of sufficient length shall be provided. Cable length shall be sufficient to terminate at control panel junction. Field verify prior to purchase.
    b. Sensor guard for each sensor.
    c. Replacement sensor cap/cartridge for each type of sensor.
    d. Sun shield(s).
    e. Probe cleaning kit(s).
    f. Provide a self-contained cleaning device which uses compressed air, tubing and a cleaning cap to periodically clean the sensor tip. Provide one per two transmitters.
    g. Manufacturer: Hach, model sc200, no equal

2.05 HAZARDOUS GAS MONITOR SYSTEM:

A. General: The hazardous gas monitors shall consist of a transmitter and remotely mounted sensors. The gas monitors shall be designed for monitoring vapors and gases typically found in wastewater.

B. Sensor:
1. Smart sensor modules shall contain all relevant sensor information within the module. This information shall include sensor manufacturer date, gas type, gas range, and calibration data. Sensor module shall store all calibration data so that the module may be calibrated off site and installed in the field without the necessity of recalibration. The sensor module shall not require a battery or power source to store this data.
2. The gas sensor shall be able to be mounted remote from the transmitter. All sensor modules shall have the capability of replacement while the unit is under power (hazardous areas) without the need for tools.
3. Combustible sensor:
    a. The combustible sensor shall use infrared technology (IR) to sense the accumulation of Methane gas present in municipal wastewater facilities.

b. The IR gas monitor shall detect for an above 100% LEL condition (over-range). This condition must be indicated locally at the unit.
c. Mounting height per manufacture recommendations.
d. Provide calibration tubing to transmitter location.
e. Warranty: 10 Year.

4. Toxic gas sensor:
   a. The toxic gas sensor shall use electrochemical technology (EC) to sense the accumulation of Hydrogen Sulfide (H2S) present in municipal wastewater facilities.
   b. Hydrogen Sulfide; 0 – 100 ppm.
   c. Mounting height per manufacture recommendations.
   d. Warranty: 1 Year.
5. Oxygen (depletion) sensor:
   a. The gas sensor shall use electrochemical technology (EC) to sense the depletion of Oxygen (O2) present in municipal wastewater facilities.
   b. Oxygen; 0 – 30% by volume.
   c. Mounting height per manufacture recommendations.
   d. Warranty: 1 Year.
6. The sensors must allow for a gas check with calibration gas. Provide tubing to allow calibration without need for use of ladder.
7. Sensors shall be factory calibrated, ready for use out of the box.

C. Transmitter:
1. Set-up and start-up of the monitor shall be so that the enclosure need not be opened during this process.
2. Transmitter shall have an operating voltage of 24 VDC.
3. The transmitter shall have a local “RESET” pushbutton for resetting latched alarms.
4. There shall be a local LCD display indicating the gas type being monitored and the concentration of gas present. The display shall alternate between the gas type (1 second) and gas concentration (5 seconds). The display shall be an integral part of the sensor/transmitter enclosure. The display shall be visible from minimum of 5 feet and shall be present always, and shall not require being turned on or off. The gas monitor display shall indicate all diagnostic check/fault conditions with a scrolling message detailing the condition. Error codes shall not be used.
5. Gas monitor will display 3 levels of alarm. Alarm levels shall be adjustable by means of a hand-held infrared controller.
6. Output:
   a. 4-20mA DC.

D. Provide cabling from sensor to transmitter, installed in conduit.

E. The gas monitor sensor/transmitter shall be in an enclosure suitable for location in Class I, Division 1, Groups B, C & D classified areas. The transmitter enclosure shall have a minimum of four entries, allowing for flexible mounting options for sensor, power, signal, and optional relay wiring.

F. Provide mounting brackets, specialize condulets and straps as required.

G. Provide Admittance Sign: 7-inch x 10-inch, aluminum, “Danger, Do Not Enter If Lights are Flashing”, one for each external door location and one located near transmitter(s). Signs shall be type which are secured to wall with non-corrosive fasteners. Self-adhesive signs are not allowed. Coordinate mounting with installing Contractor.

H. Manufacturer Capability Requirements - As a minimum, the gas monitor manufacturer must meet the following requirements:

1. The manufacturer shall supply all equipment used to check or calibrate the sensor/transmitter units as recommended, for one year. Include the following:
    a. Gas cylinder, 1 for each gas type, capable of at least 20 “bump tests”.
    b. Regulator, 1 for each gas type.
    c. Tubing.
    d. Carrying case.
2. The manufacturer shall provide on-site service with factory trained personnel. The manufacturer shall provide on-site training for owner/operator.
3. ***The manufacturer shall provide on-site calibration of sensors for a period of two years based on manufacturer’s recommended time intervals****.*

I. The sensor/transmitter shall be MSA Ultima X or X5000 Series, or equal by Drager or Det-Tronix.

2.06 HAZARDOUS GAS SYSTEM FLASHING ALARM LIGHT

A. Outdoor Location:
1. General: Flashing alarm light shall be color changing LED lamp type with gray base and clear lens.
2. Power: 120VAC.
3. NEMA 4X, CL. I, DIV. 2 rated.
4. Polycarbonate lens.
5. LED colors: Red-Amber-Green.
6. Wall mounting bracket.
7. The light fixture shall be Edwards Signaling, 105XBRi Class, Multi-Status LED.

2.07 NON-CONTACT LEVEL, RADAR TRANSMITTERS (LT):

A. General: Non-contact radar transmitter/receiver to determine level by measuring time-of-flight of a radar pulse from the radar transmitter to the product surface and back.

B. Transmitter/sensor:
1. False Target Rejection shall ignore obstructions including, but not limited to, tank walls.
2. Micro-processor based transmitter, with Bluetooth connectivity.
3. Housing: explosion proof, PVDF, IP66/IP68.
4. Accuracy: ±2 mm.
5. Output: 4-20mAdc.
6. Power: 24Vdc loop powered, intrinsically safe.
7. Suitable for installation in Class I, Division 1 Hazardous Location.

C. Accessories to be Provided:
1. Provide 316 stainless steel mounting bracket and hardware as required.
2. Provide Intrinsically safe barrier meeting manufacturers sensor requirements.

D. Manufacturer:
1. Vega Americas; VEGAPULS, C21.
2. No Equal.

2.08 FLOAT LEVEL SWITCHES (LSH / LSL):

A. Provide non-mercury, hermetically sealed, normally open, rated 10 amperes at 120-volt mechanical switch liquid level sensors, potted in a solid polyurethane float that is leak proof and shockproof.

B. Cable:

1. Shall be PVC type SJO with No. 18 AWG (minimum) conductors:
2. Jacket for cable shall be factory molded to the float.
3. Cable length shall be as required for application. Minimum cable length of 20 feet.

C. Application:
1. Wide angle (for pump control), switch activation at 45 degrees above horizontal.
2. Narrow angle (for level monitoring and alarm), switch activation at 5 degrees above horizontal. Coordinate float switch construction with chemical compatibility and specific gravity.

D. Float switches shall be suitable for mounting in Class I, Division 1, Group C, D environments.

E. Design based on Conery, 2900 Series, narrow angle or engineer approved equal.

PART 3 – EXECUTION

3.01 INSTALLATION:

A. Coordination of all field mounted instrumentation device installation shall be system Supplier's responsibility:
1. Mounting of each device shall be designed with consideration to:
a. Manufacturer's installation recommendations.
b. Ease of removal for maintenance.
c. Safety.

B. Install the control and instrumentation in accordance with drawings, shop drawings, and manufacturer's recommendations.

C. Low power DC control signal wires shall be shielded and installed in a separate steel raceway. No AC power or control wires are allowed in the same raceway. The shielded control wires shall be sized to be compatible with the distances involved and the equipment selected.

D. AC control wires shall be in separate conduit and sized to keep voltage drop within acceptable limits.

E. All wiring terminating in control panel or other devices shall be properly identified with one piece wrap on sleeve type tags or labels with machine lettering.

F. Before any circuits are energized, all internal and external electrical and mechanical clearances shall be checked to assure that all installed equipment will function safely and properly.

3.02 FIELD QUALITY CONTROL:

A. System Supplier's Field Service:
1. Arrange and pay for process control and instrumentation system Supplier's engineer to:
a. Assist with start-up and conduct performance demonstration.
b. Demonstrate operation and maintenance to the system operators.
c. Review operations and maintenance manual with system operators.
2. Schedule field services as soon as practical and at times approved by Engineer.
3. Promptly make all changes and additions required by system Supplier's engineer and as necessary for proper operation of the system.
4. System Supplier's engineer shall submit written approval of installation.

3.03 SYSTEM TRAINING

A. System Supplier's engineer shall provide training for system operators.

B. Provide training session(s) to demonstrate and explain operation of all instrumentation equipment and systems. Demonstrations and explanations shall utilize installed equipment and be "hands-on." Each training session shall be repeated so training is available during day/morning and afternoon/evening shifts to accommodate schedules of Owner's personnel. Training times shall be mutually agreed upon with Owner. Training sessions shall be held at project site.

END OF SECTION

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SECTION 40 91 13.12
REFRIGERATED SAMPLERS & SAMPLER ENCLOSURE

PART 1 - GENERAL

1.01 SCOPE:

A. Work includes all labor and materials required to install a refrigerated sampling device and a heated enclosure to house both the sampling device and flow meter transmitter.

B. Sampler shall be ISCO 5800 Refrigerated Sampler as manufactured by ISCO, or Engineer approved equal.

C. Enclosure shall be manufactured by Hubbell Power Systems, or Engineer approved equal.

1.02 RELATED SECTIONS:

A. 01 33 00 Submittals

B. 03 33 00 Cast in Place Concrete

C. 26 05 05 Basic Materials & Methods – Electrical

PART 2 - PRODUCTS

2.01 SAMPLER:

A. Sampler shall be provided with 10-liter glass sample bottle and one identical spare bottle.

B. Sampler shall be powered by 115VAC, 60Hz power at the enclosure.

C. Sampler enclosure shall be fabricated from Linear low-density polyethylene (LLDPE), and shall be suitable for operation from -20ºF to 120ºF.

D. Sampler shall be capable of providing ±5 ml or ±5% of the average volume in a set, whichever is greater, at lifts up to 25 feet. Typical accuracy of the sampler shall be ±10 ml or ±10% of programmed value, whichever is greater.

E. Provide suitable length of ¼ inch vinyl suction line with Stainless Steel strainer. Suction line shall be connected to the effluent piping in the meter chamber with a ¼ inch tap and ball valve as shown on the Drawings

F. Sampler controller shall be NEMA 4X rated, with non-volatile ROM program memory. Digital input from the flowmeter shall be 5 to 15 volt DC pulse or 25 ms isolated contact closure. Sampler controller shall have 4 programmable outputs. Controller shall be programmable from 1 to 999 samples.

G. Sampler software shall be capable of constant time – constant volume, constant time – variable volume, variable time – constant volume flow modes. Programmable sample volumes shall be 10 to 9,990 ml in 1 ml increments. Sampler shall allow operator to select automatic rinsing of suction line up to 3 rinses for each sample collection.

2.02 ENCLOSURE:

A. Enclosure shall be provided with enough space to house the sampler and all associated electrical equipment. Enclosure shall be Flip-Top Fiberglass Hot Box enclosure manufactured by Hubbell Power Systems, or engineer approved equal. Size shall be 5' x 5' with inside height as required to house the automatic sampler and accessories.

B. Enclosure shall be insulated and heated with a wall-mounted heater to accommodate the sampler and transmitter. Heater shall be provided by enclosure manufacturer.

C. Provide anchor kits as necessary for installation on concrete pad.

D. Enclosure color shall be beige.

PART 3 – EXECUTION

A. Sampler manufacturer shall inspect the installed equipment to assure proper operation.

B. Sample line shall run from the sampler enclosure to the Meter Chamber via conduit as shown on the Drawings. Conduit shall be provided with caps for use when not sampling.

C. Mount flow meter transmitter in enclosure per manufacturer's recommendations.

END OF SECTION 40 91 13.12

SECTION 40 95 10
PUMP STATION CONTROL PANELS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The work of this section includes electrical control panels for the Polishing Pond Pump Station and Biosolids Pump Station for improvements to the Biopure Treatment Facility located in Hart, Michigan.

B. Refer to specification section 40 96 35, Appendix A for the Process Control Narrative which describes the required control, monitoring and alarm functionality to be performed through the PLC control panels. Refer to same section, Appendix B for the Control System IO Schedule

1.02 RELATED SECTIONS:

A. Section 26 05 00 - Electrical General Provisions

B. Section 26 29 23 Variable Frequency Drives

C. Section 40 96 35 - Process Control System

1.03 REFERENCES:

A. Applicable Standards and Codes:
1. American National Standards Institute (ANSI).
2. American Society for Testing & Materials (ASTM).
3. Institute of Electrical & Electronic Engineers (IEEE).
4. Instrument Society of America (ISA).
5. National Electrical Code (NEC).
6. National Electrical Contractors "Standard of Installation" (NECA).
7. National Electrical Manufacturers Association (NEMA).
8. National Board of Fire Underwriters (NBFU).
9. National Fire Protection Association (NFPA).
10. Underwriters' Laboratories, Inc. (UL).

1.04 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Provide shop drawings and product data approval is required for:
1. Pump station control panels
2. Pump controller
3. Intrinsically safe relays
4. Float switches
5. Control relays and timers
6. Other major devices in pump station panels

C. Provide electrical diagrams and layout arrangement diagrams for approval. Include ladder logic diagrams with rung numbers, conductor and terminal number, coil function description, contact references and cross-references, timer settings, and device location.

D. Provide complete control panel information for approval including:
1. Scaled and dimensioned fabrication and layout drawings.
2. Detailed device bill of material referencing use and location.
3. Complete nameplate legend plate and identification plates list including annunciator point list showing wording letter size and plate size and type.

4. Schematic wiring control diagrams in ladder logic type format. Diagrams shall include rung numbers. Conductor and terminal number, coil function description, contact references and cross references, timer settings, and type device.

E. At project substantial completion provide copies operation and maintenance manuals containing detailed submittal information, record drawings and other information and renewal parts information including source location and maintenance recommendations. Provide quantity and format per Division 1.

1.05 QUALITY ASSURANCE:

A. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

B. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

C. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

D. Regulatory Requirements:
1. National Electrical Manufacturers Association (NEMA): Design features, test standards, and operating guidelines of electrical equipment shall meet minimum requirements cited in specified standard.
2. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

1.06 SPECIAL PROVISIONS:

A. The Contractor shall engage the services of:
1. A specialty custom panel builder with experience in the water and wastewater field to supply the station control panel. Qualifications of the panel builder are outlined below:
2. A control and instrumentation subcontractor with experience in installation of control systems in the water and wastewater field with qualification outlined below:

B. The control panel shall be fabricated and assembled by a vendor fabricator regularly and routinely in the special control panel business. All control panels shall be UL508A listed or listed by another nationally recognized testing lab in accordance with UL508A as an assembly. Furnish documentation for the control panel as listed below:
1. Complete bill of material of all electrical and physical components mounted in or on the control panel. Bill of materials shall include a full component description, manufacturer, and complete part number for each component.
2. Dimensioned elevation drawings that show panel size and locations of all internal and external mounted electrical components. All components shall be noted with an identification reference back to the bill of materials.
3. Three-line power wiring diagrams and control wiring diagrams. Wiring diagrams shall include proper nomenclature that reference back to the bill of material. All wiring diagrams shall include standard vertical line numbering that incorporates the drawing number for reference purposes throughout the entire drawing set (i.e., Sheet 1, line 10 = line no. 110). All control relays shown in diagrams shall include lien number reference at relay to indicate connection location of relays contacts (underline line number reference for normally-closed contacts).

C. All control and instrumentation hardware items shall be furnished but not necessarily manufactured by a single supplier who has had a minimum of two years of experience in the

manufacture of controls of the type specified herein and who has furnished and installed similar controls in at least three water control systems.

D. The custom panel builder and control and instrumentation subcontractor shall have experience in the water and wastewater field. Specifically, these organizations and individuals shall have been involved in construction and start-up of control and instrumentation on a minimum of three water or wastewater systems or more.

1.07 DESCRIPTION OF PUMP STATION MONITORING & CONTROL (POLISHING POND):

A. Refer to Section 40 96 35 APPENDIX A Process Control Narrative for description of operation for the duplex submersible pump station.

B. All level control set points and minimum/maximum variable frequency drive speeds shall be coordinated with Engineer at time of pump station startup.

C. The pumps shall be controlled via a Multitrode MultiSmart Pump Controller with a radar primary level transmitter for continuous level and flow calculation. A back up system to the pump controller shall utilize a single high-level float to override the primary pump station controls.

D. At the control panel pump control shall be selected from a local HAND-OFF-AUTO selector switch for each pump. HAND mode bypasses all primary and backup level controls allowing pumps to run continuous until OFF or AUTO mode is selected. AUTO mode uses the pump controller and primary level transmitter to control wet well level. In the event the pump controller or primary level transmitter fails the backup float system will control the wet well level.

E. Required Alarming & Monitoring:

1. Local Alarms & Monitoring: Individual alarms and monitoring in the pump station control enclosure (pilot lights on inner door of panel) shall be energized for the following:
    a. Pump Running (each pump)
    b. Pump Seal Leak / Over-Temp (each pump: indicator lights on Flygt MiniCAS motor protection relay)
    c. VFD Fault (each pump)
    d. Wet Well High Level
    e. Backup Float System Activated
2. Station Alarm: The exterior station alarm light shall be energized by the following:
    a. Wet Well High Level Alarm (pump controller)
    b. Wet Well High High Level Alarm (float switch)
    c. Station Alarm Light Manual Test Pushbutton
    d. Station Alarm light shall de-energize when alarm clears.
3. KISM/VT SCADA Remote Alarms & Monitoring: The following alarms and monitoring points shall be communicated remotely to the Owner's KISM/VT SCADA Monitoring System based on individual pump controller inputs and internal pump controller points via cellular communications gateway:
    a. Wet Well Level (4-20mA Analog Input)
    b. Pump Running (each pump)
    c. Pump Failed to Run when Call Alarm (each pump)
    d. Pump Seal Leak Alarm (each pump)
    e. Pump Over-Temperature Alarm (each pump)
    f. VFD Fault (each pump)
    g. Wet Well Low Level Alarm (pump controller)
    h. Wet Well High Level Alarm (pump controller)
    i. Wet Well High High Level Alarm (float switch)

j. Backup Float Control Activated Alarm
k. Backup Float Lag Pump Running
l. Lag Pump Running (pump controller)
m. Power Monitoring Phase Failure/Phase Loss Alarm (pump controller and phase monitor relay)
n. Motor Current & Power Monitoring and Alarm (each pump)
o. All alarms shall remain on until correction of alarm condition is completed and shall be resettable from the KISM/VT SCADA system and from the pump controller keypad/display.

4. Pump Controller Alarms & Monitoring: The following alarms and monitoring points shall be displayed on the pump controller keypad/display based on individual pump controller inputs and internal pump controller points and resettable the pump controller keypad/display:
   a. Wet Well Level (4-20mA Analog Input)
   b. Pump Running (each pump)
   c. Pump Failed to Run when Called Alarm (each pump)
   d. Pump Seal Leak Alarm (each pump)
   e. Pump Over-Temperature Alarm (each pump)
   f. VFD Fault (each pump)
   g. Wet Well Low Level Alarm (pump controller)
   h. Wet Well High Level Alarm (pump controller)
   i. Wet Well High High Level Alarm (float switch)
   j. Backup Float Control Activated Alarm
   k. Backup Float Lag Pump Running
   l. Lag Pump Running (pump controller)
   m. Power Monitoring Phase Failure/Phase Loss Alarm (pump controller & phase monitor relay)
   n. Motor Current & Power Monitoring and Alarm (each pump)
   o. All alarms shall remain on until correction of alarm condition is completed and shall be resettable from the KISM/VT SCADA system and the pump controller keypad/display.

1.08 DESCRIPTION OF PUMP STATION MONITORING & CONTROL (BIOSOLIDS):

A. Refer to Section 40 96 35 APPENDIX A Process Control Narrative for description of operation for the duplex submersible pump station.

B. All level control set points and minimum/maximum variable frequency drive speeds shall be coordinated with Engineer at time of pump station startup.

C. The pumps shall be controlled via a Multitrode MultiSmart Pump Controller with a radar primary level transmitter for continuous level monitoring. A back up system to the pump controller is not required.

D. At the control panel pump control shall be selected from a local HAND-OFF-AUTO selector switch for each pump. HAND mode bypasses all primary level controls allowing pumps to run continuous until OFF or AUTO mode is selected. AUTO mode uses the pump controller and primary level transmitter to control wet well level. In the event the pump controller or primary level transmitter fails the backup float system will control the wet well level.

E. Required Alarming & Monitoring:

1. Local Alarms & Monitoring: Individual alarms and monitoring in the pump station control enclosure (pilot lights on inner door of panel) shall be energized for the following:
   a. Pump Running (each pump)

b. Pump Seal Leak / Over-Temp (each pump: indicator lights on Flygt MiniCAS motor protection relay)
c. VFD Fault (each pump)
d. Wet Well High Level

2. Station Alarm: The exterior station alarm light shall be energized by the following:
   a. Wet Well High Level Alarm (pump controller)
   b. Station Alarm Light Manual Test Pushbutton
   c. Station Alarm light shall de-energize when alarm clears.
3. KISM/VT SCADA Remote Alarms & Monitoring: The following alarms and monitoring points shall be communicated remotely to the Owner's KISM/VT SCADA Monitoring System based on individual pump controller inputs and internal pump controller points via cellular communications gateway:
   a. Wet Well Level (4-20mA Analog Input)
   b. Pump Running (each pump)
   c. Pump Failed to Run when Call Alarm (each pump)
   d. Pump Seal Leak Alarm (each pump)
   e. Pump Over-Temperature Alarm (each pump)
   f. VFD Fault (each pump)
   g. Wet Well Low Level Alarm (pump controller)
   h. Wet Well High Level Alarm (pump controller)
   i. Lag Pump Running (pump controller)
   j. Power Monitoring Phase Failure/Phase Loss Alarm (pump controller and phase monitor relay)
   k. Motor Current & Power Monitoring and Alarm (each pump)
   l. All alarms shall remain on until correction of alarm condition is completed and shall be resettable from the KISM/VT SCADA system and from the pump controller keypad/display.
4. Pump Controller Alarms & Monitoring: The following alarms and monitoring points shall be displayed on the pump controller keypad/display based on individual pump controller inputs and internal pump controller points and resettable the pump controller keypad/display:
   a. Wet Well Level (4-20mA Analog Input)
   b. Pump Running (each pump)
   c. Pump Failed to Run when Called Alarm (each pump)
   d. Pump Seal Leak Alarm (each pump)
   e. Pump Over-Temperature Alarm (each pump)
   f. VFD Fault (each pump)
   g. Wet Well Low Level Alarm (pump controller)
   h. Wet Well High Level Alarm (pump controller)
   i. Lag Pump Running (pump controller)
   j. Power Monitoring Phase Failure/Phase Loss Alarm (pump controller & phase monitor relay)
   k. Motor Current & Power Monitoring and Alarm (each pump)
   l. All alarms shall remain on until correction of alarm condition is completed and shall be resettable from the KISM/VT SCADA system and the pump controller keypad/display.
5. KISM/VT SCADA Remote Control: The following control points shall be communicated remotely to the pump station from the Owner's KISM/VT SCADA System for remote pump control via the cellular communications gateway:
   a. Call Pump to Start (each pump)
   b. Set Pump VFD Speed (each pump)

PART 2 - PRODUCTS

2.01 EXTERIOR CONTROL PANELS (PUMP STATIONS):

A. Control Panels shall be furnished and installed as shown on the drawings and in the Special Provisions.

B. Control Panels shall be free standing, NEMA 4X type. Panels shall be fabricated from 304 stainless steel, 14-gauge (0.075") minimum thickness, welded construction with Unistrut or angle iron reinforcement frame. Front doors shall be the full height of the panel, pan type with stainless steel piano hinges, door stop kit and three-point latches. Provide exterior doors with 1/4 turn corrosion resistant padlockable handles. Panels shall be manufactured by Saginaw Controls and Engineering, Hoffman, Metro Fabricating or 'Approved' equal.

C. Exterior control panels shall be fully insulated. Insulation shall be 1" thick extruded polystyrene foam board. Dow "Styrofoam SM" or Engineer approved equal.

D. Control panel shall have interior doors constructed of 12-gauge stainless steel with continuous hinge for mounting interior disconnect switch handle, pushbuttons, pilot lights, pump monitor relays and pump controller display.

E. Panel cutouts shall be located as shown and in accordance with best panel design standards. Suitable internal front panel stiffeners shall be installed as required to prevent buckling and maintain a flat surface. All digital meter displays, ETMs, etc., shall be mounted at eye level.

F. The panel interior shall have a GFCI duplex convenience outlet as shown.

G. Panels shall have sufficient print pockets inside the access doors or panels to hold detailed wiring and interconnect diagrams. One copy of the relevant drawings shall be provided and placed in these pockets. An additional copy of detailed wiring and interconnect diagrams shall be laminated and mounted on inside surface of outer door.

H. Gray slotted plastic wire duct shall be used to route AC/DC wiring within the panels. Blue slotted plastic wire duct, marked 'INTRINSICALLY SAFE WIRING ONLY', shall be used to route intrinsically safe (IS) wiring within the panels. Wire duct shall be run in continuous length with Snap-On covers. Minimum size 2"W x 2"D. Slotted plastic wire duct shall be as manufactured by Panduit, Wire Mold, or equal.

I. The panels shall be provided with separate terminal blocks for all power, signal and control wiring to be connected to field mounted devices and circuits entering or leaving the panel. Ten percent spare terminals shall be provided.

J. Panels shall come equipped with door switched, 120VAC, LED panel light, located in top of enclosure. Light fixture shall provide a minimum of 300 lumens.

K. Nameplates shall be black plastic laminate with white filled legend engraving. Nameplates shall be adhesive attached.

L. Panels SHALL BE SIZED TO ALLOW 20% additions and modifications.

M. Provide minimum 1" x 6" x 1/4" solid copper ground bar, minimum. Bus bar shall be sized as required to provide space to conveniently terminate each ground connection to the grounding electrode/grounding electrode system. Mount ground bus on insulated bracket.

N. Provide universal ground bar with length as required to provide space to individually terminate each ground wire plus 10% spare space.

O. The panel shall be designed to allow for a minimum of 5" clearance at the bottom of the panel for field wiring and terminations. All permanently mounted devices shall be above this area.

P. Provide all labeling as required by NEC, NFPA, OSHA and UL 698A including arc flash labeling required by the NEC Code.

2.02 GENERAL CONTROL PANEL INTERIOR WIRING:

A. Power wiring outside of instrument panels and field-mounted devices shall be minimum No.12 AWG stranded, Type THWN insulation. Power wiring inside instrument panels shall be minimum No.14 AWG stranded, Type MTW insulation. Control wiring shall be No.16 AWG minimum, Type THWN insulation (MTW inside control panel). Electronic signal wiring shall be minimum No. 18 AWG twisted, shielded pairs. Provide high-density polyethylene jacketed multi-wire cable assemblies in underground conduit or duct. Wiring shall not be spliced. Wiring shall be tagged for identification with printed wire sleeves or self-stick labels.

B. All wiring to and from field-mounted devices shall be terminated at panel terminals.

C. Control Wiring Color Codes:

1. Color code requirements shall apply to control wiring in motor starters, control wiring in raceways and in control panels. All control wires shall be identified at each termination by a number label corresponding with diagrams or terminal strip labels and shall be color coded as follows:

a.	Red	AC Control	(any voltage)
b.	Yellow	AC Source External	(see note #1)
c.	Green	Ground	(120V AC earth ground)
d.	White	Neutral	(120V AC)
e.	Black	Hot	(120V AC)
f.	Orange	Telemetry and Special	(Phone lines, etc.)
g.	Brown	DC Ground	(Any voltage)
h.	Blue	DC Control + or -	(Any voltage)
i.	Lt. Blue	Intrinsically safe	(Any voltage)
j.	Black-red-blue	3 Phase conductors	under 150V to ground
k.	Brown-orange-yellow	3 Phase conductors	over 150V to ground

2. Black & Red Shielded Pair

a.	Red	Positive 4-20 mA loop, etc.
b.	Black	Negative 4-20 mA loop, etc.
c.	Clear	Ground/Shield.

3. Black & Clear Shielded Pair

a.	Clear	Positive 4-20 mA loop, etc.
b.	Black	Negative 4-20 mA loop, etc.
c.	Clear	Ground/Shield.

Note #1: The intent is that Yellow wiring shall identify circuits in compartments that may be energized even though normal power disconnecting devices may be "OPEN".

D. Wire numbers shall be provided on the panel wiring diagrams and wire markers printed with wire numbers that match the drawings shall be attached at each end of the wire for identification purposes. Wire numbers shall comply with the following numbering convention:

1. The address of the terminal the wire is coming from and the address of the terminal the wire is going to shall both appear on the wire label, separated by a "/".

2. The address of the terminal the wire is going to shall be placed closest to the terminal on the label.
3. All conductors shall be tagged at both ends. Wire labels shall be the shrink sleeve type. Hand written marking is not acceptable.
4. Wire numbers shall be based on the vertical line reference numbers shown on the control panel wiring diagrams (i.e., wire tag no. 1223 can be found on sheet 12, line 23.)
5. Wire numbers shall change by a suffix letter only when going through a device. A wire terminating through a terminal or other connection shall not change numbers.
6. I/O wiring shall be labeled identical to the I/O numbers used in the wiring diagram.

E. Furnish all equipment and accessories necessary to install system.

F. All wiring installation shall be executed in a workmanlike manner, and shall be grouped, bundled, supported and routed horizontally and vertically, to provide neat appearance. All connections to devices remote from the panel shall be executed through terminal blocks.

G. Signal wiring shall be segregated from control power wiring, grouped functionally and arranged neatly to facilitate circuit tracing. No combination of analog, digital input or control output wiring shall be intermixed within the same bundle or duct within a panel. DC signal wires shall be segregated from AC signal wires. Provide adequate spacing for intrinsically safe (IS) wiring.

H. Where lugs are required, provide locking fork (ring lugs on equipment grounds) with insulating sleeves. Lugs shall be sized according to wire size and crimped with a ratchet type crimper.

I. Where shielding is required, shields shall be continuous foil or metalized plastic providing 100% coverage. A drain wire in continuous contact with the shield shall be included. Drain wires shall be connected to ground at one end. Shielded wire that connects field devices shall be connected to ground inside originating panel enclosure (only).

J. Power distribution blocks shall be used as required for 480 V power distribution wiring within the panel or enclosure. Power distribution blocks shall be sized according to wiring requirements in the panel.

K. Provide separate 1" x 6" x 1/4" copper ground bus in panel for grounding requirements in the panel.

2.03 PANELBOARDS / LOAD CENTER (PP1):

A. Construction: Panelboard shall be molded case circuit breaker type with main breaker. Terminals shall be anti-turn solderless compression type, UL listed for type of wire specified. Gutters shall be 4 inches minimum with adequate size for wire used. Boxes shall be fabricated from code gauge galvanized steel without knockouts. Fronts shall be dead front safety type with concealed hinges and shall be painted with rust inhibiting primer and baked enamel finish. Door shall have flush stainless steel cylinder tumbler type locks with spring loaded door pulls. Printed directory inside door shall be typewritten card encased in clear plastic cover with complete descriptions. Door shall have engraved laminated plastic nameplate with legend in black letters on white face and punched for mechanical fastening to door. Legend shall be single line of text with 1/2-inch high lettering on 1-1/2 inch high label (2-inches where two lines are required) and shall match terminology and numbering shown in Contract Documents and approved shop drawings.

B. Bussing: Shall be copper, distributed phase sequence type, 100 amps, 98% conductivity hard drawn copper or as shown on Panelboard Schedule or on drawings. Mounting hardware shall be placed behind usable space.

C. Circuit Breakers: Shall be plug-on type unless otherwise shown, quick make and break toggle action, with thermal and magnetic protection. Handle position indicator shall show ON, OFF, and TRIPPED, and shall be centered. Breakers shall be single handle, common trip, 2-pole and 3-pole type (handle ties are not acceptable) and shall be UL listed for type of wire specified.
1. Provide HACR breakers as required by the load.
2. Provide UL type SWDL switching duty on 120v circuits for switched circuits.
3. Provide switch neutral common trip per NEC 514-5 for fuel pumps.

D. Panelboard Ratings: UL listed short circuit rating (integral equipment rating).
1. Up to 240 Volts: 10,000 RMS symmetrical amp minimum.
2. Up to 480 Volts: 22,000 RMS symmetrical amp minimum.

E. Manufacturers: Square D, or Eaton Corp.

2.04 WIRING DEVICES:

A. Manufacturers: Appleton Electric Company, Arrow-Hart, Inc., Crouse-Hinds Company, Hubbell Wiring Device Division, or Pass and Seymour, Inc.

B. Factory fabricated, specification grade wiring devices in type, color, and electrical rating for service indicated. Devices for same project shall be of one manufacturer.

C. Ground-Fault Circuit Interrupter Receptacles (GFCI): Shallow depth, NEMA 5-20R configuration, with noise suppression and line and load terminal screws, feed through. Standard duplex wall plates shall fit. Unit shall be 120 VAC., 20A, UL Class A and shall meet requirements of UL 943 ground-fault circuit interrupters.

D. Wiring Device Plates and Covers:
1. Wall plates for wiring devices with ganging and cut outs as indicated, provided with metal screws for securing plates to devices, screw heads colored to match finish of plate.
2. Plates for Flush Mounted Devices: No. 430 brushed steel.
3. Device plates for surface mounted Type FS or FD boxes shall be Type FSK galvanized steel.
4. Device plates for surface mounted, 4-inches square boxed, shall be 1/2-inch raised galvanized steel covers.
5. Weatherproof plates and covers for exterior devices or devices in damp locations to be galvanized gray cast malleable with gasketed, lift cover plate as shown on drawings.

2.05 PILOT LIGHTS, PUSHBUTTONS AND SELECTOR SWITCHES:

A. Mount selector switches or pushbuttons on starter covers except where indicated otherwise.

B. Operator Buttons: 30mm all metal operators with polyethylene color inserts, designed to accept any combination of contact blocks. Painted buttons are not acceptable.

C. Contact Blocks: Molded high arc resistant material with a minimum of one "normally open" and one "normally closed" contact, having a continuous current rating of 10 amperes.
1. All terminals shall be readily accessible.

2. Blocks shall easily be changed and arranged for easy addition of additional contacts.

D. Pushbuttons and selector switch operators shall be compatible for nominal 30mm mounting holes in the control panel and pushbutton stations. Operators shall be one complete assembly including the pushbutton or selector switch, contact blocks, and nameplate. The operators shall be black unless noted otherwise in the specifications or drawings. Contact blocks shall be provided as required for proper control and operation.

E. Pushbutton operators shall be configured for momentary or maintained operation depending on the control function required per the specifications and drawings. Pushbuttons shall be non-illuminated Selector switch operators shall be configured as 2-position or 3-position maintained or momentary (spring return to a select position) depending on the control function required per the specifications and drawings. Selector switch shall have a standard knob handle that does extend beyond the edge of the switch housing. Knob handle shall clearly indicate position of switch.

F. Indication pilot lights shall be compatible for nominal 30mm mounting holes in the control panel. Pilot lights shall be a steady on LED push-to-test style light that operates at full voltage on 120VAC or 24V AC/DC power. Provide plastic color lens for indicating pilot light as indicated on the drawings.

G. Operators and indication pilot lights for outdoor locations shall be watertight and oil resistant, rated NEMA 4/13. Pilot light design based on Allen-Bradley Bulletin 800T.

2.06 RELAY SYSTEMS:

A. Control and Auxiliary Relays: Provide plastic enclosed plug-in with contacts rated not less than 10 amperes at 120VAC contact arrangement to be double pole or three pole, as required, double throw. Plug-in sockets to be 8-pin or 11-pin tube type with screw terminals for mounting on DIN rail or backplates. Acceptable manufacturers are Allen-Bradley, Square D, Potter Brumfield or Idec.

B. Time Delay Control Relays: The time delay control relays for "on" delay or "off" delay circuits plug-in type shall be of double pole double throw plastic enclosed. Contacts shall be rated not less than 10 amperes at 120VAC and continuous duty timing circuit and coil. Relays shall have calibrated dial and knob adjustment with time range as required. The relays shall be as manufactured by Allen-Bradley, Square D, Potter-Brumfield, Magnecraft, or other approved equal.

C. Intrinsically Safe Relays: The intrinsically safe relays shall have 120V AC primary element or coil with two 10 ampere 120V AC rated electrically independent contacts and low voltage control circuit with a maximum operating sensitivity of 1000 ohms. Relays shall be as manufactured by Warrick, Inc. Series 17, B-W Co. Series 53, or Pepper/+ Fuchs

D. Phase Monitor Relays: Diversified Electronics SLA-440-ALE or approved equal.

2.07 PANEL HEATERS:

A. Heater kW output shall be sized to maintain a temperature within the panel for electronic devices (motor starters, transmitters, pump controller, etc.) to properly operate within specification during normal ambient conditions for the cold season. Minimum rating shall be 400 watts.

B. Electric heaters should be centered as low as possible on an interior enclosure panel.

C. For maximum efficiency and longevity, the heater should be mounted in a vertical position with the terminal block to the bottom and the air outlet openings at the top in a sealed enclosure free from dust or debris.

D. Do not install heaters on wood panels.

E. Heat sensitive components should not be placed near the heater discharge area.

F. Electric heaters are not designed for use in dusty, dirty, corrosive, or hazardous locations.

G. Heater can only be installed in a totally enclosed metal enclosure.

H. Heater shall be manufactured by Hoffman or equal.

2.08 COOLING FANS:

A. Cooling fan package shall include fan, air filter, composite air plenum, finger guard, and grille.

B. Air filter shall provide good arrestment of airborne dirt with minimal pressure drop.

C. Durable composite air plenum and grille shall take up minimal enclosure space. Plenum shall permit even airflow through the filter for maximum filtering efficiency. Unit shall contain an integral and removable finger guard on either side of the plenum.

D. Air filters shall be accessible for cleaning from outside the enclosure.

E. Fan impellers shall be dynamically balanced and molded from polycarbonate material.

F. Cooling fan shall be sized to provide a minimum CFM to provide heat relief for motor starters, variable frequency drives and other electronic devices to prevent overheating.

G. Fan shall conform to UL 508, CSA and CE standards.

H. Cooling fan shall be manufactured by Hoffman, SCE, or approved equal.

2.09 LOUVERS:

A. Louvers shall provide ventilation in enclosure to reduce excessive internal heat or moisture.

B. Louver plates shall be made from 14-gauge steel with an ANSI 61 gray polyester powder finish over phosphatized surfaces.

C. Louver shall be furnished with necessary hardware mounting.

D. Louver shall be furnished with washable aluminum air filter.

E. Louver shall be manufactured by Hoffman, SCE or approved equal.

F. Provide sealed stainless steel metal rain shroud around perimeter of louver frame to prevent exposure to rain and snow. Shroud shall be fabricated to match similar metals to enclosure.

G. Louver shall be manufactured by Hoffman, SCE or approved equal.

2.10 TERMINAL BLOCKS:

A. Provide 35mm DIN rail (channel) mount terminal blocks, as required, rated at 300V, 30A maximum, for interconnections with field equipment.

B. Terminal blocks shall be sectional type, have white marking strip for numbered identification, connections, recessed screw heads compression clamp, test point and comb type jumper(s).

C. Segregate terminal blocks used for DC signals, AC control and power wires.

D. Power distribution blocks (PDB) shall be used as required for 480 V power distribution wiring within the panel or enclosure. Power distribution blocks shall be sized according to wiring requirements in the panel.

E. Allen-Bradley Model 1492 terminal blocks or approved equal.

2.11 SURGE SUPPRESION DEVICES (SPD):

A. General Requirements:
1. Tested for 10,000 operations of simulated lightning wave shapes.
2. The case shall be constructed of aluminum.

B. Low Voltage Lightning and 480VAC Delta, Three-Phase Surge Suppression:
1. System shall be rated for 600 volt maximum.
2. Able to withstand individual strokes of over 40,000 amps without deterioration.
3. System shall be listed and labeled by U.L.
4. Manufacturer: Transtector model I2R Series or approved equal.

C. Low Voltage Lightning and 120/ 240VAC Single-Phase Surge Suppression (Load Center Mounted):
1. System shall be rated for 150 volt maximum.
2. Able to withstand individual strokes of over 10,000 amps without deterioration.
3. System shall be listed and labeled by U.L.
4. Manufacturer: To match provided control panel Load Center.

2.12 STATION ALARM LIGHT:

A. NEMA 4X steady-on beacon, with RED shatter resistant polycarbonate lens. Light source shall be LED.

B. Operating Voltage: 120 VAC.

C. Design based on Edwards Signaling Model 48XBRMR120A. Equal by Appleton or Killark acceptable.

2.13 ELAPSED TIME METERS:

A. Meter shall be an odometer style, non-resettable 6-digit display.

B. Meter shall be designed for panel mount applications with 2 1/2" round face.

C. Voltage: 120 VAC.

D. Shall be accurate to 0.025%.

E. Wire connections via spade type terminals.

F. Manufacturers: Yokogawa 240 Series or Engineer approved equal.

2.14 CONTROL POWER TRANSFORMERS

A. Provide NEMA 3R, dry type encapsulated control power transformers as required and indicated on drawings. Control power transformers shall be of capacity and voltage rating as indicated on drawings. Control transformer shall be suitable for mounting external to pump station control panel enclosure.

B. Manufacturer: Eaton Corp., Square D, or Engineer approved equal.

2.15 THERMOSTATS:

A. Thermostats controlling electric heaters and cooling fans shall be heavy duty line voltage rated 16 amps at 120V for pilot duty sized for the contactor coil load, adjustable range 45°F to 85°F.

B. Single pole double throw suitable for energizing the electric heat load on falling temperature or energizing the electric cooling load on rising temperatures.

C. The thermostat shall be Hoffman or equal by Honeywell or Chromalox.

2.16 FUSES:

A. 250 v Fuses: Class J, one-end rejection or to fit mountings specified, 1/10 to 600 amps, 200,000 amp interrupting rating.

B. Bussmann Low-Peak. LPN-R, dual element, time delay with short circuit protection for motor, transformer, welder, feeder, and main service protection.

C. 600 v Fuses:
1. Class RK 1, one-end rejection or to fit mountings specified, 1/10 to 600 amps, 200,000 amp interrupting rating. Bussmann Low-Peak, LPS-R, dual element, time delay with short circuit protection for motor, transformer, welder, feeder and main service protection.
2. Class CC, fast acting, single element, 1/10 to 30 amps, 200,000 amp interrupting rating. Bussmann Limitron KTK-R, UL listed for motor control circuits, lighting ballasts, control transformers, and street lighting fixtures.
3. Class L, bolt-in type, 601 to 6000 amps, 200,000 amp interrupting rating. Bussmann Hi- Cap, KRP-C, time delay for overload and short circuit protection for motor, transformer, feeder, and main service protection.

D. Spare Fuses: for each type provide the following:
1. Power Fuses: One spare of each type and rating.
2. Control Circuit Fuses: 10% or minimum of three (3) of each type and rating.

E. Manufacturers: Bussmann, Gould Shawmut, or Littelfuse.

2.17 AC & DC POWER SUPPLIES:

A. 24V DC and 12V AC din-rail mountable power supply shall be provided in control panels where required for use with 24V DC and 12V AC rated equipment.

B. Coordinate power supply capacity and sizing so it meets or exceeds I/O, control and communication equipment power requirements.

C. For 24V DC power supply, input voltage shall be single-phase, 120VAC. Output of the power supply shall be 24-28V DC, output current as required.

D. For 12V AC power supply, input voltage shall be single-phase, 120VAC. Output of the power supply shall be 12 AC, output current as required.

E. Manufacturer: Allen-Bradley, Sola, Phoenix Contact or approved equal.

2.18 PUMP CONTROLLER – MULTITRODE MULTISMART; NO EQUAL:

A. The pump controller shall provide "Out of the box" control of a typical pump station, with an intuitive user-interface. The pump controller shall come with pre-built configuration parameters which are selectable via the user interface and a PC configuration program including:
   1. Setpoint adjustment for pump activation/deactivation and level alarms.
   2. Level device from 4-20mA or conductive sensor; redundant level device handling.
   3. Selectable between fill/empty
   4. Functionality for advanced pump control of up to 9 pumps including grouping and alternation.
   5. Station optimization including:
      a. Max off time (odor reduction)
      b. Maximum pumps to run (overload protection)
      c. Maximum starts per hour (pump protection)
      d. Inter-pump start and stop delays
      e. Maximum run time (turn off inefficient or partially blocked pumps)
      f. Blocked pump detection
      g. Well washer controls
      h. Well clean out (periodic pump down to snore point)
   6. Multiple profiles of setpoints for spill management, off peak pumping, tariffing, etc.
   7. Datalogger of 50,000 events.
   8. 3-phase voltage monitoring and the following protective functions:
      a. Under-voltage
      b. Over-voltage
      c. Loss-of-phase
      d. Phase rotation
   9. Monitoring of DC supply, battery voltage, and internal temperature.
      a. The pump controller shall provide a flow calculation feature. An integral algorithm to calculate pump flow rate and flow totalization shall be included.

B. Programmability
   1. The product shall have the option of a logic engine to enhance/interact with the pump controller.
   2. The product shall have the option of IEC61131-3 PLC programming language to enhance/interact with the pump controller.

C. I/O
   1. The I/O shall be expandable to many hundreds of I/O points per unit.
   2. Available I/O points shall include:
      a. Digital inputs (voltage free input), also configurable as counters.
      b. Digital outputs (240V, 5A resistive).
      c. Analog inputs (10bit)
      d. Analog outputs (10bit)

3. Digital inputs configurable for seal, thermistor, and other pump station requirements.
    a. Seal sensor
    b. PTC Thermistor
    c. Flygt FLS & CLS
    d. Conductive sensor for liquid level sensing

D. User Interface - The field shall include a user interface for operations and configuration. The display shall provide status of most aspects of the pump station, control of pumps, resetting of faults, and configuration of parameters.
1. Status - The following parameters shall be displayed on the main screen:
    a. Level
    b. Setpoints for alarms and pump start/stop
    c. Pump running/stopped
    d. Pump available
    e. Pump fault
    f. 3-phase voltage supply
2. The screen will have buttons to allow the user to access faults, history, information and settings.
3. Information screens - The following parameters shall be available via a user key press from the main screen:
    a. Hours run accumulators for each pump and the station with the following comparisons:
        1) Last minutes run
        2) This hour, last hour
        3) Today, yesterday
        4) This week, last week
        5) Total hours run
    b. Starts accumulators for each pump and the station with the following comparisons:
        1) This hour, last hour
        2) Today, yesterday
        3) This week, last week
        4) Total starts
    c. Flow values derived from calculations, including inflow, pump flow rate, total volume.
    d. Any overflow information, including start time, duration, estimated volume.
    e. Status of all I/O
4. Control - The following aspects of the system, as a minimum, shall be controlled intuitively through the user-interface:
    a. Pump mode, for each pump, between Auto/Manual(Hand)/Off
    b. Pump fault reset
    c. Level alarm reset
5. Fault screen
    a. The main screen shall include a fault button which takes the user to a fault screen and allows them to check all current and unacknowledged alarms.
    b. The fault screen will detail the fault (e.g., contactor fail, seal fault, motor over-temp etc.) along with date/time that each fault occurred and cleared.
    c. A reset option for a fault will be presented to the user when faults can be acknowledged/reset.
6. History screen - The main screen shall include a history button which takes the user to a history screen and allows them to check all faults and events along with date/time. The history screen shall include the ability to filter to view only faults, only events, or narrow down to events relating to specific types of data.
7. Configuration - The user interface should allow intuitive configuration of the system, including as a minimum:
    a. Set-points, including alarm and pump setpoints

b. Enable/disable level alarms (so that for example, the low level alarm can be easily activated or deactivated).
c. Start, stop and alarm delays
d. Alternation/fixed sequence and grouping of pumps where necessary
e. Configure I/O
   1) Assign primary/backup level to any input, e.g., 4-20mA or level sensor
   2) Assign pre-defined (or user-defined) faults, e.g., thermal overload, contactor fail, to any digital input.
   3) Zero and span analog inputs
   4) Set digital outputs to change state with any digital tag in the system
   5) Set Analog outputs to follow any analog value, including primary level
f. Fault configuration - Set each fault as either:
   1) Display only
   2) Manual/SCADA restart
   3) Auto restart with configurable restart time.
g. Pump station optimization parameters such as:
   1) Max off time (odor reduction)
   2) Maximum pumps to run (overload protection)
   3) Maximum starts per hour (pump protection)
   4) Inter-pump start and stop delays
   5) Maximum run time (turn off inefficient or partially blocked pumps)
   6) Well washer controls
   7) Well clean out (periodic pump down to snore point).
h. Supply protection
   1) Under-voltage and over-voltage alarm points
   2) DC-supply alarm point
i. Communications ports, speeds and addresses
j. The configuration of the unit shall also allow the user to save a known configuration on the unit itself for reference and revert-back-to capability.

8. Maintainability - The supplier shall demonstrate that their system is maintainable in the future, especially that future applications do not incur any user-interface development cost to the end user, i.e., the user interface shall be an integral part of the system.

E. Communications
1. Physical - the product shall include
   a. Ethernet 10Mbit/s
   b. Multiple RS232 ports to 115kBit/s
2. Media - The system shall support a variety of communications networks including:
   a. Private radio over RS232
   b. PSTN
   c. Wireless LAN
   d. Cellular voice and cellular data
3. Protocols - The communications protocol will be an open protocol such as DNP3 which includes:
   a. Change of state reporting
   b. Native date/time and quality stamps for each data point
   c. Event buffering for different classes of data
   d. Modbus master/slave protocol

F. Provide unit with integral algorithm to calculate pump flow rate and flow totalization.

G. Provide unit with motor protection expansion board (3MP) and current transformers sized for motor loads.

2.20 UNMANAGED INDUSTRIAL-GRADE ETHERNET SWITCHES:

A. Managed Ethernet switches shall be provided with the 5-port configuration.

B. Managed Ethernet switch shall have the following specifications:
1. 10/100BaseTX, autosensing, duplex RJ-45 ports
2. Rugged industrial enclosure, DIN-rail mountable
3. Vibration, shock and humidity ratings shall be suitable for industrial use
4. 0°C to 60°C (32°F to 140°F) operating temperature range
5. 10-30 VDC nominal input voltage.

C. Manufacturer: Allen Bradley, Hirschmann, Moxa or Cisco.

2.21 ETHERNET PROGRAMMING PORT:

A. Industrial type, Cat-6, RJ-45/RJ-45 bulkhead coupler with:
1. Single 15 amp, 120 VAC, GFCI receptacle.
2. 3 amp circuit breaker.
3. NEMA 12/4 with cover for panel face mounting.

B. Manufacturer: Grace Engineered Products, Graceport; Hubbell, Panel-safe; or equal.

2.22 INDUSTRIAL LTE GATEWAY:

A. Gateway shall be provided to allow cellular remote pump station control, monitoring and alarming via Owner's KISM/VT SCADA System.

B. Gateway shall have the following specifications:
1. Host Interfaces:
a. 10/100/1000 Ethernet (RJ45)
b. RS-232 serial port (DB-9)
c. USB 2.0 Micro-B Connector
d. 3 SMA antenna connectors (primary, diversity, GPS)
e. Active GPS antenna support
2. Input/Output:
a. Configurable I/O pin on power connector
b. Digital Input ON Voltage: 2.7 to 36 VDC
c. Configurable Pull-up for dry contact input
d. Digital Open Collector Output > sinking 500 mA
e. Analog Input: 0.5-36 VDC
3. LAN (Ethernet/USB):
a. DNS, DNS Proxy
b. DHCP Server
c. IP Passthrough
d. VLAN
e. Host Interface Watchdog PPPoE
4. Serial:
a. CP/U DP PAD Mode
b. Modbus (ASCII, RTU, Variable)
c. PPP
d. DNP3 Interoperability
5. Network and Routing:
a. Network Address Translation (NAT)
b. Port Forwarding
c. Host Port Routing
d. NEMO/DMNR
e. VRRP

f. Reliable Static Route
g. Policy Routing Verizon ANTM IPv6 Gateway

6. VPN:
   a. IPsec, GRE, and OpenVPN Client
   b. Up to 5 concurrent tunnels
   c. Split Tunnel
   d. Dead Peer Detection (DPD)
   e. Multiple Subnets
7. Events Engine:
   a. Custom event triggers and reports
   b. Configurable interface, no programming
   c. Event Types: Digital Input, Network Parameters, Data Usage, Timer, Power, Device Temperature and Voltage
   d. Report Types: RAP, SMS, Email, SNMP Trap, TCP (Binary, XML, CSV)
   e. Event Actions: Drive Relay Output
8. Security:
   a. Remote Authentication (LDAP, RADIUS, TACACS+) DMZ
   b. Inbound and Outbound Port filtering
   c. Inbound and Outbound Trusted IP
   d. MAC Address Filtering
   e. PCI compatible
9. Application Frame work:
   a. ALEOS Application Framework (AAF)
   b. LUA Scripting Language
   c. Eclipse-based IDE
   d. Integrated with AirVantage®
   e. Dual-Core Processing
10. Satellite Navigation:
   a. 12 Channel GPS and GLONASS Receiver
   b. Acquisition Time: 1 s Hot Start
   c. Accuracy: <2 m (50%), <5 m (90%)
   d. Tracking Sensitivity: -145 dBm
   e. Reports: NMEA 0183 V3.0, TAIP, RAP, XORA
   f. Multiple Redundant Servers
   g. Reliable Store and Forward
11. Gateway Management Interfaces:
   a. ALMS
   b. Local web user interface
   c. AT Command Line Interface (Telnet/SSH/Serial)
   d. SMS Commands
   e. SNMP
12. Power:
   a. Input Voltage: 7 to 36 VDC
   b. LTE Idle Power: 900mW (75 mA @ 12VDC)
   c. Standby Mode Power: 53 mW (4.4 mA @ 12 VDC) triggered on low voltage, I/O or periodic timer
   d. Low voltage disconnect to prevent battery drain
   e. Built-in protection against voltage transients including 5 VDC engine cranking and +200 VDC load dump
   f. Ignition Sense with time delay shutdown
   g. Configurable features and ports to optimize power consumption
13. Environmental:
   a. Operating Temperature: -40°C to +70°C / -40°F to +158°F
   b. Storage Temperature: -40°C to +85°C / -40°F to +185°F
   c. Humidity: 90% RH @ 60°C
   d. Military Spec MIL-STD-810G conformance to shock, vibration, thermal shock, and humidity
   e. IP64 rated ingress protection

14. Accessories:
    a. DC Power Cable
    b. AC Adapter, 12VDC
    c. DIN Rail Bracket
15. Warranty:
    a. 3 year standard warranty
16. Provide vandal-resistant cellular antenna and associated antenna cabling.
17. Provide 2 years of prepaid cellular service at both Polishing Pond and Biosolids Pump Stations. Coordinate cellular provider with Owner.
18. Manufacturer: Sierra Wireless Model RV50X gateway, no equals allowed.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Low power DC control signal wires shall be shielded and installed in a separate steel raceway. No AC power or control wires are allowed in the same raceway. The shielded control wires shall be sized to be compatible with the distances involved and the equipment selected.

B. AC control wires shall be in separate conduit and sized to keep voltage drop within acceptable limits.

C. All intrinsically safe wiring entering the pump station control panel and terminating at IS barriers, shall be physically separated by a metal shroud.

D. All wiring terminating in control panel or other devices shall be properly identified with one-piece wrap on sleeve type tags or labels with machine lettering.

E. Before any circuits are energized, all internal and external electrical and mechanical clearances shall be checked to assure that all installed equipment will function safely and properly.

F. Pump station Control panel shall be shimmed level and grouted, shall bear evenly over the full length and be installed plumb.

G. All conduit routed in the field shall adhere to the following installation requirements:
    1. Exposed conduit above grade shall be threaded rigid galvanized steel.
    2. Below grade conduit shall be schedule 40 PVC conduit with rigid steel conduit for all vertical elbows and extensions to above grade.
    3. Minimum buried depth: 24 inches below top of conduit.
    4. All conduit and wiring routed to standby generator (where required) shall be routed below grade and stub up under the protected frame of the generator enclosure.
    5. Provide NEMA 7/9 (explosion proof) fittings, boxes and wiring devices for all wiring routed to the wet well or below grade vaults in accordance with Article 500 of the NEC code.

H. All generator ancillary circuits (coolant heater, etc.) shall be fed from load center panel in the pump station control panel. Provide properly sized branch breakers accordingly.

I. Provide grounding with ground rods of length required to achieve specified ground resistance of 25 ohms or less (per ground rod). Use three rods driven in triangle formation and connected in parallel. Provide ground rods at location shown (multiple rods may be required to achieve specified resistance).

J. Bond the non-current carrying parts of all electrical equipment installed under this contract including metallic raceways, raceway supports, motors, equipment enclosures, and metallic cable sheaths by means of bare copper cable or copper strap to the station grounding system or as shown.

K. Ground conductors run in conduit with circuit conductors are to be securely connected inside the junction boxes or enclosures. Splices in ground conductors shall be made by the "Cadweld" process by Erico Products, Inc., Continental Industries "Thermoweld", or equal.

L. All circuits in non-metallic raceways shall include a ground conductor sized per the NEC or as shown. Attach grounding conductors to equipment by means of hex head cap screws or machine bolts after the contact surfaces have been cleaned to bright metal. Ground conductors terminating at the ground bus in the pump station control panel.

3.02 START-UP:

A. Contractor shall provide personnel for one (1) day, a minimum of 8 hours, to perform operational start up, system check out and de-bugging of the system installation with Engineer and Owner's Representative.

B. Contractor shall provide written notice to the Engineer forty-eight (48) hours in advance of intended start-up visit.

3.03 TRAINING:

A. Contractor shall provide four (4) hours to train the facility personnel in the operation, adjustment and maintenance of the pump station control system.

B. Scheduling and coordination for instructing the Owner's operators shall be by written request of the Contractor.

3.04 SPARE PARTS:

A. Provide one spare relay of each type used to Owner. Obtain signed receipt and transmit copy to Engineer.

END OF SECTION

SECTION 40 95 13
PROCESS CONTROL PANELS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The work of this section includes Headworks Control Panel HCP Wastewater Treatment Facility Control Panel TCP and other control enclosures associated with the control system and instrumentation for control and monitoring of the Hart Biopure Treatment Facility Headworks Building Grit Removal System, Rotary Drum Screen System and other ancillary systems in the Headworks Building and Wastewater Treatment Facility North & South Clarifier Rooms and Blower Room.

B. Refer to specification section 40 96 35, Appendix A for the Process Control Narrative which describes the required control, monitoring and alarm functionality to be performed through the PLC control panels. Refer to same section, Appendix B for the Control System IO Schedule.

1.02 RELATED WORK:

A. Section 26 05 00 - Electrical General Provisions

B. Section 40 96 35 - Process Control System

1.03 SUBMITTALS:

A. Submit under the provisions of Division 1.

B. Provide shop drawings and product data for all items approval data is required for:
1. Panels and enclosures.
2. Overcurrent devices (circuit breakers, fuses) per Sections 26 28 13 and 26 28 17.
3. Control relays and timers
4. Wiring terminal strips
5. Miscellaneous wiring devices (receptacles, door switches, thermostats, light switches, etc.)
6. Other control system components, PLCs, interface devices, control software, etc.

C. Provide electrical diagrams and layout arrangement diagrams for approval. Include ladder logic diagrams with rung numbers, conductor and terminal number, coil function description, contact references and cross-references, timer settings, and device location.

D. Provide complete control panel information for approval including:
1. Scaled and dimensioned fabrication and layout drawings.
2. Detailed device bill of material referencing use and location.
3. Complete nameplate legend plate and identification plates list including annunciator point list showing wording letter size and plate size and type.
4. Schematic wiring control diagrams in ladder logic type format. Diagrams shall include rung numbers, conductor and terminal number, coil function description, contact references and cross references, timer settings, and device type.

E. At project substantial completion, per Division 1, provide operation and maintenance manuals bound in a spiral hard cover binder containing detailed record drawings as provided above and renewal parts information including source location and maintenance recommendations.

1.04 SPECIAL PROVISIONS:

A. The Contractor shall engage the services of:
1. A specialty custom panel builder with experience in the water and wastewater field to supply PLC control panels. Qualifications of the panel builder are outlined below.
2. A control and instrumentation subcontractor with experience in installation of control systems in the water and wastewater field with qualification outlined below.

B. The control panel shall be fabricated and assembled by a vendor fabricator regularly and routinely in the special control panel business. All control panels shall be UL508A listed or listed by another nationally recognized testing lab in accordance with UL508A as an assembly. Furnish documentation for the control panel as listed below:
1. Complete bill of material of all electrical and physical components mounted in or on the control panel. Bill of materials shall include a full component description, manufacturer, and complete part number for each component.
2. Dimensioned elevation drawings that show panel size and locations of all internal and external mounted electrical components. All components shall be noted with an identification reference back to the bill of materials.
3. Three-line power wiring diagrams and control wiring diagrams. Wiring diagrams shall include proper nomenclature that reference back to the bill of material. All wiring diagrams shall include standard vertical line numbering that incorporates the drawing number for reference purposes throughout the entire drawing set (i.e., Sheet 1, line 10 = line no. 110). All control relays shown in diagrams shall include lien number reference at relay to indicate connection location of relays contacts (underline line number reference for normally-closed contacts).

C. All control and instrumentation hardware items shall be furnished but not necessarily manufactured by a single supplier who has had a minimum of two years' experience in the manufacture of controls of the type specified herein and who has furnished and installed similar controls in at least three water and wastewater control systems.

D. The custom panel builder and control and instrumentation subcontractor shall have experience in the water and wastewater field. Specifically, these organizations and individuals shall have been involved in construction and start-up of control and instrumentation on a minimum experience of ten (10) projects in water or wastewater systems. These qualifications shall be outlined in detail with the Contract Proposal and shall be subject to the approval of the Engineer and the Owner's Representative.

1.01 DELIVERY, STORAGE AND HANDLING:

A. All instrumentation equipment shall be stored and protected from dampness and humidity during construction.

B. Touch up or refinish damaged paint.

PART 2 – PRODUCTS

2.01 CONTROL ENCLOSURES & CABINETS:

A. Control panels shall be furnished and installed as shown on the drawings and in the Special Provisions.

B. Control panels shall be free standing or wall-mount, NEMA 12 type. Panels shall be fabricated from mild rolled steel, 12-gauge minimum thickness, welded construction with u-channel or angle iron reinforcement frame. Front door(s) shall be the full height of the panel, pan type with stainless steel piano hinges and three-point latches. Panels shall be manufactured by Saginaw Controls and Engineering, Hoffman, or 'Approved' equal.

C. Panel cutouts shall be located as shown and in accordance with best panel design standards. Suitable internal front panel stiffeners shall be installed as required to prevent buckling and maintain a flat surface.

D. Panel surfaces shall have all scale, rust and rough spots ground smooth. The entire unit shall be cleaned, degreased and phosphatized. Interior backplate only shall be finished with 3 coats of semi-gloss polyurethane paint applied over a rust inhibitive primer. Panel backplate shall be white. Panel exterior surface shall be gray.

E. The panel interior shall have a GFCI duplex convenience outlet as shown.

F. Panels shall have sufficient print pockets inside the access doors or panels to hold detailed wiring and interconnect diagrams. One copy of the relevant drawings shall be provided and placed in these pockets.

G. The panels shall be provided with separate terminal blocks for all power, signal and control wiring to be connected to field mounted devices and circuits entering or leaving the panel. Ten percent spare terminals shall be provided.

H. Control panels SHALL BE SIZED TO ALLOW 20% I/O additions and modifications

2.02 SURGE SUPPRESSION:

A. All control panels shall include a surge suppressor on the incoming 120VAC control power feed to the panel and/or PLC power supply, UL 1449 Edition 3 compliant. Surge suppressor shall be SASD type with local and remote status indication, Transtector, Bussmann or approved equal.

2.03 OPERATOR INTERFACE TERMINAL (OIT):

A. Provide and industrial computer style OIT inside the control panel enclosure and mounted in the control panel enclosure door face.

B. OIT shall come equipped with all necessary components, power supplies, and communication cables for a complete system.

C. OIT shall be capable of communicating information to and from Allen-Bradley CompactLogix PLCs.

D. PanelView Plus:

1. Units shall have 10" color Active Matrix Thin Film Transistor (TFT), touch screen. 800x600 resolution with 18 bit color graphics.
2. Internal 512MB RAM, 512 MB storage.
3. 80MB nonvolatile storage for applications.
4. Communication Ports: Ethernet/IP communication protocol, RJ-45 UTP connection and one USB ports.
5. Secure Digital (SD) card slot:
6. Hot-swappable card slot supports 1784-SD2 SD cards for transferring files, upgrading firmware, or logging data. Provide 2 spare.
7. Units shall operate on 120VAC.
8. NEMA 12/13/4X sealed front panel.
9. Manufacturer: Allen-Bradley PanelView Plus 7

2.04 PROGRAMMABLE LOGIC CONTROLLER (PLC):

A. PLC controller shall come equipped with all components, power supply, IO interface cards, wiring terminals and communication cables for a complete control system.

B. The controller shall be capable of being programmed from a PC / Laptop.

C. PLC shall be Allen-Bradley / Rockwell Automation CompactLogix 5730 L3 controller with Ethernet communication capability. The PLC shall be 1769-L33ER model. No equals are permitted.

D. PLC memory size shall be appropriate for accomplishing control tasks plus 50% greater providing for future expansions to the control program.

E. Provide PLC I/O cards to satisfy current system I/O requirements plus 25% spare I/O capacity.

F. PLC shall be capable of communicating directly (without protocol converters and transducers) to process system's Operator Interface Terminals and other PLCs via Ethernet I/P protocol.

G. Each PLC output including pilot lights must be individually fused if not individually fused on the output card of module. Fused wiring arms are allowed.

H. Power Requirements: 120V AC +10%, 60 Hz.

I. Operating Temperature: 10°F to 130°F.

J. Operating Humidity: 0 through 90% relative humidity.

K. The controller shall have FM, UL and CSA approval.

L. Provide 1769-series I/O modules and accessories matched to the PLC for a completely functional system.

2.05 24V AND 12V DC POWER SUPPLIES:

A. 24V and 12V DC din-rail mountable power supply shall be provided in control panels where required for use with 24V and 12V DC rated equipment.

B. Coordinate power supply capacity and sizing so it meets or exceeds I/O and control and communication equipment power requirements.

C. For 24V DC power supply, input voltage shall be single-phase, 120VAC. Output of the power supply shall be 24-28V DC, output current as required.

D. For 12V DC power supply, input voltage shall be single-phase, 120VAC. Output of the power supply shall be 12 DC, output current as required.

E. Manufacturer: Allen-Bradley, Sola or approved equal by Engineer.

2.06 GENERAL CONTROL PANEL INTERIOR WIRING:

A. Power wiring outside of instrument panels and field-mounted devices shall be minimum No.12 AWG stranded, Type THWN insulation. Power wiring inside instrument panels shall be minimum No.14 AWG stranded, Type MTW insulation. Control wiring shall be No.16 AWG minimum, Type THWN insulation (MTW inside control panel). Electronic signal wiring shall be minimum No. 18 AWG twisted, shielded pairs. Provide high-density polyethylene jacketed multi-wire cable assemblies in underground conduit or duct. Wiring shall not be spliced. Wiring shall be tagged for identification with printed wire sleeves or self-stick labels.

B. All wiring to and from field-mounted devices shall be terminated at panel terminals.

C. Control Wiring Color Codes:

1. Color code requirements shall apply to control wiring in motor starters, control wiring in raceways and in control panels. All control wires shall be identified at each termination by a number label corresponding with diagrams or terminal strip labels and shall be color coded as follows:

a.	Red	AC Control	(any voltage)
b.	Yellow	AC Source External	(see note #1)
c.	Green	Ground	(120V AC earth ground)
d.	White	Neutral	(120V AC)
e.	Black	Hot	(120V AC)
f.	Orange	Telemetry and Special	(Phone lines, etc.)
g.	Brown	DC Ground	(Any voltage)
h.	Blue	DC Control + or -	(Any voltage)
i.	Lt. Blue	Intrinsically safe	(Any voltage)
j.	Black-red-blue	3 Phase conductors	under 150V to ground
k.	Brown-orange-yellow	3 Phase conductors	over 150V to ground

2. Black & Red Shielded Pair

a.	Red	Positive 4-20 mA loop, etc.
b.	Black	Negative 4-20 mA loop, etc.
c.	Clear	Ground/Shield.

3. Black & Clear Shielded Pair

a.	Clear	Positive 4-20 mA loop, etc.
b.	Black	Negative 4-20 mA loop, etc.
c.	Clear	Ground/Shield.

Note #1: The intent is that Yellow wiring shall identify circuits in compartments that may be energized even though normal power disconnecting devices may be "OPEN".

D. Wire numbers shall be provided on the panel wiring diagrams and wire markers printed with wire numbers that match the drawings shall be attached at each end of the wire for

identification purposes. Wire numbers shall comply with the following numbering convention:

4. The address of the terminal the wire is coming from and the address of the terminal the wire is going to shall both appear on the wire label, separated by a "/".
5. The address of the terminal the wire is going to shall be placed closest to the terminal on the label.
6. All conductors shall be tagged at both ends. Wire labels shall be the shrink sleeve type. Hand written marking is not acceptable.
7. Wire numbers shall be based on the vertical line reference numbers shown on the control panel wiring diagrams (i.e., wire tag no. 1223 can be found on sheet 12, line 23.)
8. Wire numbers shall change by a suffix letter only when going through a device. A wire terminating through a terminal or other connection shall not change numbers.
9. I/O wiring shall be labeled identical to the I/O numbers used in the wiring diagram.

E. Furnish all equipment and accessories necessary to install system.

F. All wiring installation shall be executed in a workmanlike manner, and shall be grouped, bundled, supported and routed horizontally and vertically, to provide neat appearance. All connections to devices remote from the panel shall be executed through terminal blocks.

G. Signal wiring shall be segregated from control power wiring, grouped functionally and arranged neatly to facilitate circuit tracing. No combination of analog, digital input or control output wiring shall be intermixed within the same bundle or duct within a panel. DC signal wires shall be segregated from AC signal wires. Provide adequate spacing for intrinsically safe (IS) wiring.

H. Where lugs are required, provide locking fork (ring lugs on equipment grounds) with insulating sleeves. Lugs shall be sized according to wire size and crimped with a ratchet type crimper.

I. Where shielding is required, shields shall be continuous foil or metalized plastic providing 100% coverage. A drain wire in continuous contact with the shield shall be included. Drain wires shall be connected to ground at one end. Shielded wire that connects field devices shall be connected to ground inside originating panel enclosure (only).

J. Power distribution blocks shall be used as required for 480 V power distribution wiring within the panel or enclosure. Power distribution blocks shall be sized according to wiring requirements in the panel.

K. Provide separate 1" x 6" x 1/4" copper ground bus in panel for grounding requirements in the panel.

2.07 CONTROL RELAYS:

A. Control and Auxiliary Relays: Provide plastic enclosed plug-in with contacts rated not less than 10 amperes at 120VAC contact arrangement to be double pole or three pole, as required, double throw. Plug-in sockets to be 8-pin or 11-pin tube type with screw terminals for mounting on DIN rail or backplates. Acceptable manufacturers are Allen-Bradley, Square D, Potter Brumfield or Idec.

B. Provide industrial control relays four poles or more with interchangeable reversible cartridge type N.O.-N.C. contacts and the contacts shall be rated 10 amperes at 120V AC and shall have a continuous duty coil. Provide relay-mounting straps for grouped mounted relays. The relays shall be Allen-Bradley, Bulletin 700P, Square D, Class 8501, Type X, or General Electric

C. Time Delay Control Relays: The time delay control relays for "on" delay or "off" delay circuits plug-in type shall be of double pole double throw plastic enclosed. Contacts shall be rated not less than 10 amperes at 120VAC and continuous duty timing circuit and coil. Relays shall have calibrated dial and knob adjustment with time range as required. The relays shall be as manufactured by Allen-Bradley, Square D, Potter-Brumfield, Magnecraft, or other approved equal.

2.08 INDICATION PILOT LIGHTS:

A. Indication pilot lights shall be compatible for nominal 30.5mm mounting holes in the control panel. Pilot lights shall be a steady on LED push-to-test style light that operates at full voltage on 120VAC or 24V AC/DC power. Provide plastic color lens for indicating pilot light per requirements of the drawings and specifications.

B. Indication pilot lights for outdoor locations shall be watertight and oil resistant, rated NEMA 4/13. Pilot light design based on Allen-Bradley Bulletin 800T or equal by Square D, Eaton, and Adalet.

C. Indication pilot lights for panels and enclosures in outdoor and general indoor locations shall be watertight and oil resistant, rated NEMA 4/13. Pilot light design based on Allen- Bradley Bulletin 800T or equal by Square D, Eaton, and Adalet.

D. Indication pilot lights for panels and enclosures (Rated NEMA 4X) in corrosive and wet locations shall be corrosive resistant, watertight and oil resistant, rated NEMA 4/4X/13. Pilot light design based on Allen-Bradley Bulletin 800H or equal by Square D, Eaton, and Adalet.

E. Indication pilot lights for panels and enclosures in hazardous Class I, Div 1 &2 locations shall be rated NEMA 7/9. Pilot light design based on Allen-Bradley Bulletin 800H or equal by Square D, Eaton, and Adalet.

2.09 PUSHBUTTONS AND SELECTOR SWITCHES:

A. Pushbuttons and selector switch operators shall be compatible for nominal 30.5mm mounting holes in the control panel and pushbutton stations. Operators shall be one complete assembly including the pushbutton or selector switch, contact blocks, and nameplate. The operators shall be black unless noted otherwise in the specifications or drawings. Contact blocks shall be provided as required for proper control and operation.

B. Contact blocks shall have a continuous current rating of 10 amps

C. Pushbutton operators shall be configured for momentary or maintained operation depending on the control function required per the specifications and drawings. Pushbuttons shall be non-illuminated and flush with the button housing.

D. Selector switch operators shall be configured as 2-position or 3-position maintained or momentary (spring return to a select position) depending on the control function required per the specifications and drawings. Selector switch shall have a standard knob handle that does extend beyond the edge of the switch housing. Knob handle shall clearly indicate position of switch.

E. Operators for panels and enclosures in general indoor locations shall be watertight and oil resistant, rated NEMA 4/13. Operator design based on Allen-Bradley Bulletin 800T or equal by Square D, Eaton, and Adalet

2.10 PANEL HEATERS:

A. Heater kW output shall be 200W at the minimum, or as noted on the drawings.

B. Electric heaters should be centered as low as possible on an interior enclosure panel.

C. For maximum efficiency and longevity, the heater should be mounted in a vertical position with the terminal block to the bottom and the air outlet openings at the top in a sealed enclosure free from dust or debris

D. Do not install heaters on wood panels.

E. Heat sensitive components should not be placed near the heater discharge area.

F. Electric heaters are not designed for use in dusty, dirty, corrosive, or hazardous locations.

G. Heater can only be installed in a totally enclosed metal enclosure.

H. Heater shall be manufactured by Hoffman or equal.

2.11 MISCELLANEOUS:

A. Provide 120VAC, 15A convenience duplex receptacles for general power in the panel and other applications as required. Receptacle shall have finger-safe wiring connections. Hubbell, Pass & Seymour, or Leviton are acceptable.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Terminate conduits in cabinet with lock nut and bushing.

B. Vacuum clean cabinet on completion of installation of all components and wiring.

C. Securely anchor cabinets to the concrete base slab, its support structure and/or wall.

D. Assure that doors fit snugly but do not bind upon completion of installation.

E. Provide ample spacing (minimum of 3.5 inches center line to center line) between all door mounted operators and indicating lights. All lights and pushbutton operators shall be mounted at or above 42" from floor level and no higher than 72".

F. Install the control system in accordance with drawings, shop drawings, and manufacturer's recommendations.

G. Low power DC control signal wires shall be shielded and installed in a separate steel raceway. No AC power or control wires are allowed in the same raceway. The shielded control wires shall be sized to be compatible with the distances involved and the equipment selected.

H. AC control wires shall be in separate conduit and sized to keep voltage drop within acceptable limits.

I. All wiring terminating in control panel or other devices shall be properly identified with one-piece wrap on sleeve type tags or labels with machine lettering.

J. Before any circuits are energized, all internal and external electrical and mechanical clearances shall be checked to assure that all installed equipment will function safely and properly.

K. Instrument control panel shall be shimmed level and grouted, shall bear evenly over the full length and be installed plumb.

3.02 START-UP:

A. Contractor shall provide personnel for one (1) day, a minimum of 8 hours, to perform operational start up, system check out and de-bugging of the system installation with Engineer and Owner's Representative.

B. Contractor shall provide written notice to the Engineer forty-eight (48) hours in advance of intended start-up visit.

3.03 TRAINING:

A. Contractor shall provide four (4) hours to train the facility personnel in the operation, adjustment and maintenance of the pump station control system.

B. Scheduling and coordination for instructing the Owner's operators shall be by written request of the Contractor.

3.04 SPARE PARTS:

A. Provide one spare relay of each type used to Owner. Obtain signed receipt and transmit copy to Engineer.

B. Provide a spare copy of the PLC program file(s) on a USB style flash drive and mount the flash drive in the control panel.

C. Provide a spare copy of the OIT program file(s) on a USB style flash drive and mount the flash drive in the control panel.

END OF SECTION

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SECTION 40 96 35
PROCESS CONTROL SYSTEM

PART 1 - GENERAL

1.01 GENERAL:

A. The general provisions of the contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this section for the following:
   1. Proposed pump station control panels for operation of the proposed Biosolids Pump Station and replacement of the Polishing Pond Pump Station.
      a. Establish cellular network communications between the Biosolids Pump Station and Polishing Pond Pump Station control panels to the existing Hart Biopure Facility KISM/VT SCADA System.
      b. Integration of Biosolids Pump Station and Polishing Pond Pump Station into the existing Hart Biopure Facility KISM/VT SCADA System.
   2. Proposed Headworks Control Panel for operation of the proposed Headworks Building process and ancillary equipment.
      a. Establish SCADA network communications between the Headworks Building control panel to the existing Hart Biopure Facility KISM/VT SCADA System
      b. Integration of Headworks Building process and ancillary equipment into the existing Hart Biopure Facility KISM/VT SCADA System
   3. Proposed Treatment Control Panel for operation of the proposed Headworks Building process and ancillary equipment.
      a. Establish SCADA network communications between the North Clarifier Room control panel to the existing Hart Biopure Facility KISM/VT SCADA System
      b. Integration of North Clarifier Room process and ancillary equipment into the existing Hart Biopure Facility KISM/VT SCADA System
   4. Provide required programming and graphics at the Hart Biopure Facility KISM/VT SCADA System for monitoring, control and alarming of the pump station, process control panels, Biosolids Basins Aerators and other ancillary process equipment.
   5. Provide required modifications to existing Biopure Treatment Facility Main Control Panel (MCP) as described on the drawings.

B. The requirements of Divisions 26 and 40 specifications shall govern work specified in this section, where applicable.

1.02 RELATED SECTIONS:

A. Division 26 - Electrical Specifications

B. Section 40 95 10 - Pump Station Control Panels

C. Section 40 95 13 – Process Control Panels

1.03 PREFERRED SYSTEM INTEGRATOR:

A. System integration of the existing Hart Biopure Facility KISM/VT SCADA System with proposed modifications to the existing Treatment Building Main Control Panel (MCP) and proposed new Treatment Building Control Panel (TCP), Headworks Control Panel (HCP), Biosolids Pump Station Control Panel and Polishing Pond Pump Station Control Panel shall be performed by Kennedy Industries, Automation Group. The Contractor is responsible for scheduling and including in his bid all costs associated with programming, graphics and updates as well as establishing cellular communications from the pump station control panels and SCADA network communications from the Headworks Building control panel and Treatment Building Control Panel to the existing Hart Biopure Facility

KISM/VT SCADA System. Contact Brett Pethers of Kennedy Industries at 248-877-0387 for quote and coordination.

1.04 DESCRIPTION OF WORK:

A. General:
1. Work included shall consist of all materials, labor, equipment, supervision, fees, services and all related items which are necessary and reasonably incidental to the proper completion of and preparation for continuous and satisfactory service of all PROCESS CONTROL SYSTEM work as indicated on the drawings and by the requirements of the specifications.

B. Description of System and Work:
1. This section provides a general description and intent of the system and the work intended to be performed under the 'General Contract' for the monitoring, control and operation of the Polishing Pond Pump Station, Biosolids Pump Station, Headworks Building and East/West Biosolids Basins.
2. Refer to drawings and specifications for equipment locations, monitoring, and control and instrumentation information.
3. The overall control and monitoring system work scope is composed of the following information:
   a. For description of control and monitoring design intent see:
      1. Specification Section - 40 95 10 Pump Station Control Panels
      2. Specification Section 40 95 13 Process Control Panels
      3. Section 40 96 35 APPENDIX A “Process Narrative”.
   b. For pump station control and monitoring points to the City of Hart KISM/VT SCADA System se:
      1. Specification Section 40 95 10 Pump Station Control Panels
      2. Specification Section 40 96 35 “APPENDIX B IO SCHEDULE”.
   c. Instrumentation and control system components furnished and installed under this specification section. Items in this category include, but are not limited to:
      1. Specification Section 40 95 10 - Pump Station Control Panels
      2. Specification Section 40 95 13 – Process Control Panels
      3. Specification Section 40 91 00 - Process Instrumentation
4. General work scope includes the following:
   a. Fabrication of pump station control panels, process control panels and modifications to existing control panels for the Hart Biopure Treatment Facility improvements. This includes internal wiring and mounting of new instrumentation and control components inside the proposed control panels as indicated on the drawings and described in this specification section.
   b. Furnish configuration, programming, software, testing, graphics, startup, and training of process control system as described and noted on the drawings and in this section. This includes, but is not limited to:
      1. Pump Controllers for pump station control panels and other associated control and monitoring functions. The Contractor shall provide a copy of the Pump Controller parameter settings.
      2. Existing main control panel MCP PLC and other associated control and monitoring functions. The Contractor shall provide a copy of the revised MCP PLC programming.
      3. Proposed Headworks Control Panel HCP PLC, Operator Interface Terminal OIT and other associated control and monitoring functions. The Contractor shall provide a copy of the HCP PLC and OIT programming.

4. Proposed Treatment Control Panel TCP PLC, Operator Interface Terminal OIT and other associated control and monitoring functions. The Contractor shall provide a copy of the HCP PLC and OIT programming.
5. Hart Biopure Facility KISM/VT SCADA System programming and graphics associated with the Polishing Pond and Biosolids Pump Stations, Biosolids Basins Aerators and Headworks Building. Graphics representation and functional interface on KISM/VT SCADA screens shall be similar to those currently used with similar controls, buttons, monitoring, alarming and various other indicators. This also includes matching the KISM/VT SCADA status color coding scheme (colors used to represent 'running, 'stop', 'alarm', 'out of service', etc.).

c. Furnish and install all conduit, wiring, cable and electrical support equipment for all process and control equipment as described in the contract documents. Wire and terminate the components per the submittal shop drawings.

1.05 SUBMITTALS:

A. Submit under provision of Section 01 33 00 - Submittals.

B. Manufacturer's Data: Submit manufacturer's standard product data (cut sheets) on the following:
1. Manufacturer's catalog selection and product information sheets for data and signal wire (shielded).
2. Manufacturer's catalog sheets for each instrument.
3. Data sheets for each component by tab number and description. Information shall include pertinent manufacturing and calibration data.
4. Control panel components.

C. Bill of Materials: Submit a bill of materials for all process control components and instrumentation components.

D. Shop Drawings:
1. All shop drawings shall be prepared per the requirements of Section 01 33 00.
2. Submit detailed drawings prepared specifically for this project for all work and accessories including, but not necessarily limited to:
a. Instrument loop diagrams showing every instrument, recorder and process controller for each loop.
b. Schematic wiring diagrams and instrument/control panel details. These shall show point-to-point wiring details complete with cable and terminal numbers.

E. Installation Instructions: Submit manufacturer's installation instructions.

F. Operating and Maintenance Instructions: Submit manufacturer's operating instructions and maintenance and repair data, complete with parts list. O&Ms shall also include all instrumentation software, graphical interface screens and program on disk

G. Warranty: Submit manufacturer's product warranty (for not less than a one-year period after successful start-up and test at the permanent installation location) for replacement of materials and equipment used in the PROCESS CONTROL SYSTEM.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Contractor shall provide all labor and equipment to receive and store this equipment, control panels, and instrumentation (on site). Coordinate desired delivery date with all trades.

B. Damaged Equipment: Do not install damaged, dented or cracked equipment; replace and return damaged units to equipment supplier/manufacturer.

1.07 WARRANTY:

A. Refer to General Conditions for specified warranty/guarantee.

PART 2 – PRODUCTS

2.01 FIELD MOUNTED INSTRUMENTS & CONTROL COMPONENTS:

A. Refer to Section 40 91 00 - Process Instrumentation to be furnished by the Instrumentation Contractor.

B. Refer to Section 40 95 10 - Pump Station Control Panels and Section 40 95 13 – Process Control Panels to be furnished by the Instrumentation Contractor.

PART 3 - EXECUTION

3.01 COORDINATION:

A. Coordinate all work with the Engineer, Owner and other trades.

B. Coordinate the entire process control system with the inputs being furnished by other equipment suppliers or already existing. Inputs and outputs will be required between the Devices and the instrumentation / control panels.

C. All work shall be coordinated with the Engineer. Work must be sequenced such that no prior system is rendered inoperative or unusable until its replacement system has been installed, tested and proven operational.

3.02 INSPECTION AND FIELD WIRING IDENTIFICATION:

A. Contractor must examine the areas and conditions under which PROCESS CONTROL AND INSTRUMENTATION SYSTEM are to be installed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.03 INSTALLATION:

A. Install PROCESS CONTROL SYSTEM components where shown, in accordance with the equipment manufacturer's written instructions, and with recognized industry practices, to ensure that the sets comply with the requirements and serve the intended purposes. Comply with ISA standards, requirements of National Electrical Code, and applicable portions of NECA's "Standard of Installation" pertaining to installation of controls.

3.04 FIELD QUALITY CONTROL:

A. Testing and Calibration:
1. After installation and calibration of all instrumentation and control equipment and appurtenances, each instrument loop shall be tested under actual operating conditions in the presence of the Engineer and Owner. The tests shall demonstrate that the control system performs as specified and appurtenances necessary to perform the tests shall be provided by the Contractor.
2. After installation of equipment and termination of all wiring, test and calibrate the entire system. Any wiring terminations or installation details found to be not in accordance with the 'Approved' shop drawings and wiring diagrams shall be promptly corrected by the responsible 'Installing' Contractor at no additional cost to the Owner.
3. Any defects shall be promptly corrected.

3.05 START-UP:

A. Contractor to provide personnel for two (2) days, a minimum of 16 hours, to perform operational start up, system check out and de-bugging of the proposed system integration into the existing Owner's KISM/VT SCADA System with Engineer and Owner's Representative.

B. Contractor shall provide written notice to the Engineer forty-eight (48) hours in advance of intended start-up visit.

C. Contractor shall provide clean water for pump station startup and testing with forty-eight (48) hours' notice.

3.06 TRAINING:

A. Contractor shall provide four (4) hours to train the facility personnel in the operation, adjustment and maintenance of the Pump station.

B. Scheduling and coordination for instructing the Owner's operators shall be by written request of the Contractor.

END OF SECTION

1.01 GENERAL

SCADA monitoring, indication and alarming shall be communicated to the existing Hart BioPure Treatment Facility KISM/VT SCADA System. The existing control system is cellular based and allows for display of data and control from any web browser. It is the intent to provide a complete SCADA system that integrates proposed monitoring and control with the existing control and monitoring system. The Contractor shall be responsible for reviewing the existing system and shall provide added functionality as specified.

The control and monitoring system shall function as the control center and data acquisition center for the BioPure Treatment Facility including the proposed improvements of screening and grit removal in the Headworks, Polishing Pond Pump Station, Return Activated Sludge Pump system, Biosolids Pump Station, Biosolids Aerators, and Clarifier No.3.

1.02 HEADWORKS:

A. Functional Intent

The control system shall be capable of performing the following functions:

- Monitor and display status for the screening system
- Monitor and display status for the grit removal system
- Monitor and display status for the non-potable water (NPW) system
- Monitor and display gas monitoring alarms
- Record runtimes for all motors
- Provide alarm notification
- Log system alarms

B. Screening System

Specification Section 46 21 33 addresses the Screening System. Screen controls will be provided by the manufacturer. The rotary drum screen will operate based on direction from the manufacturer-supplied programmable logic controller (PLC) housed in a manufacturer's equipment panel (MEP) labeled as Rotary Drum Screen Control Panel (SCP).

SCADA monitoring, indication and alarming shall include the signals listed in Appendix B – I/O List. Signals shall be conveyed to the KISM/VT SCADA system via the Headworks Control Panel (HCP).

C. Grit Removal System

Specification Section 46 23 00 addresses the Grit Removal System. Grit paddle, grit pump and grit classifier controls will be provided by the manufacturer. The grit removal system will operate based on direction from the manufacturer-supplied PLC housed in a MEP, labeled as the Grit Control Panel (GCP).

SCADA monitoring, indication and alarming shall include the signals listed in Appendix B – I/O List. Signals shall be conveyed to the KISM/VT SCADA system via the Headworks HCP.

D. Building Ventilation System

Refer to 23 09 93 Sequences of Operation and Appendix B – I/O List.

E. Hazardous Gas Monitoring System

Refer to Specification Section 40 91 00 Process Instrumentation and Appendix B – I/O List. Gas monitors will be installed in the Headworks to monitor the concentration of Hydrogen Sulfide, Oxygen and the presence of combustible gas as a percent of the lower explosive level (LEL).

An indicator/transmitter will display the level of each of the Hydrogen Sulfide, Oxygen and percent LEL and provide analog signals to the HCP for local display and communication to the KISM/VT SCADA system.

Provide user adjustable settings for alarm at the HCP OIT with the following initial setpoints:

Hydrogen Sulfide ≥1 ppm

Oxygen - < 20%

LEL - > 5 %

Provide user selection at the HCP OIT of "Active" or "Out of Service" for the gas monitor sensors to allow for maintenance activities. When a sensor is "Out of Service", alarm lights shall be illuminated to signal the need for caution and testing with a portable sensor before access.

Alarms will be generated in the KISM/SCADA system. In addition, alarms will generate an output that illuminates the four alarm lights AL1, AL2, AL3, and AL4.

F. Non-Potable Water System

See Section 33 11 13 for detailed description of the functionality of the NPW system. SCADA monitoring, indication, and alarming is required. The signals noted in Appendix B – I/O List shall be monitored by SCADA.

1.03 CLARIFIERS:

A. Functional Intent

The control system shall be capable of performing the following functions:

- Maintain existing monitoring and display of existing clarifier signals
- Monitor and display run status for the proposed Clarifier No. 3
- Monitor and display over torque condition at Clarifier No. 3
- Provide for Clarifier No. 3 shutdown on over-torque
- Monitor and display high level in the scum well in Clarifier No. 1, Clarifier No. 2 and Clarifier No. 3.
- Record runtimes for all motors
- Provide alarm notification
- Log system alarms

1.04 POLISHING POND PUMP STATION

A. The description of controls is for a duplex submersible pump station. Pump Station controls will via a Multitrode MultiSmart Pump Controller provided by the pump supplier and installed in the

Polishing Pond Pump Station Control Panel (PPCP). Data from the pump controller will be shared with the KISM/VT SCADA system via cellular modem for monitoring, indication, and alarming as listed in Appendix B – I/O List.

B. All level control set points and minimum/maximum variable frequency drive (VFD) speeds shall be coordinated with Engineer at time of pump station startup.

C. The pumps (PP1 and PP2) for the Polishing Pond Pump Station shall be controlled via a Multitrode MultiSmart Pump Controller with a primary radar level transmitter for continuous level and flow calculation. A backup system to the pump controller shall utilize a high-high level float and time delays to override the pump station controls.

D. At the PPCP, pump control shall be selected at a local HAND-OFF-AUTO selector switch. Modes shall function as described below.

E. Sequence of Operation Directed by MultiSmart Pump Controller:

1. Pump Control HAND-OFF-AUTO selector switch in “Auto” mode:
   a. All operation levels noted below are provided in the Drawings.
   b. As the liquid level in the wet well rises to a predetermined adjustable “Pump On” elevation, the primary level transmitter shall signal the pump controller to activate a pump.
   c. The “Lead” pump is determined by the automatic alternating feature of the pump controller and shall be alternated for each pump down cycle.
   d. With the “Lead” pump operating, the wet well liquid level lowers to a predetermined adjustable “Pump Off” elevation, and the primary level transmitter shall signal the pump controller to deactivate the pump(s).
      i. The “Lead” pump shall be programmed to turn on at the predetermined adjustable minimum speed of the VFD. Initially, with only the “Lead” pump called to run, the output speed signal to the VFD shall be increased or decreased based on the rate-of-rise or rate-of-decrease measured by the primary level transmitter in the wet well in a predetermined range of water level. As the water level in the wet well increases, the speed of the pump will proportionally increase to draw the level in the wet well down. As the water level decreases in the wet well, the speed of the pump will proportionally decrease in speed to a predetermined minimum speed.
      ii. When more than one pump is required to run as described below, all pump speed signals shall be equally increased or decreased based on the rate-of-rise or rate-of-decrease measured by the primary level transmitter in the wet well in a predetermined range of water level.
   e. The "Pump Off" setting shall be above the pump motor and equal to the low water level of the Polishing Pond.
   f. When the “Lead” pump is operating and the liquid level continues to rise above the predetermined adjustable “Lag Pump On” elevation, the primary level transmitter shall signal the pump controller to start the “Lag” pump and ramp both pumps to a predetermined adjustable speed. The pump controller shall incrementally adjust the speed of both pumps as required to lower the wet well level as described in paragraph 1.c above.
   g. With “Lead” and “Lag” pumps operating, the wet well liquid level lowers to the “Pump Off” setting as signaled by the primary level transmitter and the pumps are deactivated. Both pumps shall ramp down (adjustable at each VFD) to zero speed.

2. Pump Control HAND-OFF-AUTO selector switch in "Hand" mode: The selected pump shall be activated and ramped to a specific speed to allow the operator to bypass the pump controller and primary level transmitter to reduce the wet well liquid level for maintenance purposes. The pump(s) shall run continuously until the "Auto" or "Off" mode is selected by the operator.

3. Pump Control HAND-OFF-AUTO selector switch in "Off" mode: The pump is out of service and shall not operate. All alarms shall still activate in the "Off" position.

4. Backup Float Control ENABLE-DISABLE selector switch in "Enable" mode:
   a. As a backup to the pump controller and primary level transmitter, a high-high-float and time delays shall provide alternate backup control for the pump(s). Float switch circuits shall be intrinsically safe.
   b. If the liquid level in the wet well rises above the predetermined adjustable "Pump On," "Lag Pump On," and "High Level" elevations of the pump controller and primary level transmitter, the high-high level float switch shall activate the "Lead" pump at a preset speed for a predetermined adjustable time, after which the pump shall be deactivated. The high-high level float switch elevation shall be above the primary level transmitter "High Level" elevation.
   c. After a predetermined adjustable time delay with the "Lead" pump operating and the high-level float switch remaining activated, the "Lag" pump shall be activated and ramped to a preset speed. Both "Lead" and "Lag" pumps shall operate for a predetermined adjustable time, after which both pumps shall be deactivated.

5. Backup Float Control ENABLE-DISABLE selector switch in "Disable" mode: The backup float system is deactivated and allows for servicing and maintenance of the high-high level float switch without inadvertently activating the pump(s).

F. Required Alarming & Monitoring:

1. Local Pump Station Alarms & Monitoring: Individual alarms and monitoring in the pump station control enclosure (pilot lights on inner door of panel) shall be energized for the following:
   a. Pump Running (each pump)
   b. Pump Seal Leak / Pump Over-Temp (each pump: indicator lights on MiniCAS motor protection relay)
   c. Variable Frequency Drive Fault (each pump)
   d. Wet Well High Level (float switch)
   e. Lag Pump Running
   f. Backup Float System Activated

2. Station Alarms: The exterior station alarm light shall be energized by the following:
   a. Wet Well High Level (pump controller output)
   b. Wet Well High-High Level (float switch)
   c. Station Manual Test and Reset Pushbuttons
   d. The exterior station alarm light shall be de-energized automatically when the alarm condition is cleared.

3. KISM/VT SCADA Remote Alarms & Monitoring: The alarms and monitoring points noted in Appendix B – I/O List shall be communicated remotely to the KISM/VT SCADA Monitoring System based on individual pump controller inputs and internal pump controller points via cellular communications gateway. The same alarms and

monitoring points shall also be displayed on the pump controller keypad/display and resettable at the pump controller keypad/display.

In addition, an alarm shall be generated by the KISM/VT SCADA system if radio communication or level signal from the Multi-Smart is lost.

4. All alarms shall remain activated until correction of alarm condition is completed.

1.05 EXISTING RAS PUMPS RAS1, RAS2, and RAS3

A. The existing return activated sludge (RAS) pumps currently use programming in each pump VFD to accomplish flow pacing independent of the SCADA system. The existing flow pacing system should be removed from service and replaced with control from the KISM/VT SCADA system. Contractor shall be responsible for changing existing VFD parameters and make programming changes in the SCADA system as necessary to accomplish this.

B. Each of the existing RAS pumps will be equipped with an individual flow meter on the discharge piping for each pump as part of this project.

C. Normal operation consists of one RAS pump being used for each clarifier that is in use. Typically, RAS1 or RAS2 is dedicated to the north clarifier when the north clarifier is in operation and RAS2 or RAS3 is dedicated to the south clarifier when the south clarifier is in operation. Modify existing KISM/VT SCADA Sludge Pumps screen for operator selection of active pumps as follows:

1. RAS1 – North Clarifier, Standby, or Out of Service
2. RAS2 – North Clarifier, Standby, South Clarifier, or Out of Service
3. RAS3 – South Clarifier, Standby or Out of Service

D. Controls shall be provided to start and stop the RAS pump or pumps selected as serving a clarifier and allow for pacing of the RAS pumps in one or two pump operation utilizing a speed reference signal from the KISM/VT SCADA system.

E. Utilizing the existing RAS flow analog input, provide a software PID loop in the KISM/VT SCADA system to smoothly vary the active RAS pump(s) speed to meet a flow setpoint. Allow for operator entry of flow setpoint as a fixed value (as gallons per minute). PID loop shall utilize the individual flow meter at each RAS pump discharge to compare to the setpoint.

F. Three pump operation shall not be allowed when under SCADA control.

G. Provide an alarm if a RAS pump is running and total RAS flow is lower than 200 gpm.

H. Provide an alarm in the event of a VFD fault at any of the RAS pumps.

I. Modify the existing “Sludge Pumps” screen to allow for designation of active pumps and entry of a flow setpoint for each RAS Pump.

1.05 PROPOSED CLARIFIER NO. 3 RAS PUMPS RAS4 and RAS5

A. Two proposed RAS pumps (RAS4 and RAS5) will serve the proposed Clarifier No. 3. Allow for designation of one of these pumps as Lead and one as Standby. Only one pump is intended for use at a time.

B. RAS4 and RAS5 are served by a single discharge meter.

C. Controls shall be provided to start and stop the lead Clarifier No. 3 RAS pump and allow for pacing of the RAS pump utilizing a speed reference signal from the KISM/VT SCADA system.

D. Utilizing the Clarifier No. 3 RAS flow analog input, provide a software PID loop in the KISM/VT SCADA system to smoothly vary the active RAS pump(s) speed to meet a flow setpoint. Allow for operator entry of flow setpoint as a fixed value (as gallons per minute) PID loop shall utilize the shared RAS4/RAS5 flow meter to compare to the setpoint.

E. Two pump operation shall not be allowed when under SCADA control.

F. Provide an alarm if a Clarifier No. 3 RAS pump is running and total RAS flow is lower than 200 gpm.

G. Provide an alarm in the event of a VFD fault at any of the RAS pumps.

H. Modify the existing "Sludge Pumps" screen to allow for designation of the lead Clarifier No. 3 RAS pump and entry of the Clarifier No. 3 RAS flow setpoint.

1.05 PROPOSED RAS/WAS CONTROL VALVE

A. A new electrically actuated valve is proposed to allow for wasting from the RAS discharge header in the Blower Room.

B. Controls shall be provided to select whether the RAS/WAS Control Valve is in "Auto" or "Out of Service". When in "Auto" a software PID in the KISM/VT SCADA System shall smoothly vary the position of the valve to maintain an operator WAS flow setpoint. When set to "Out of Service", the control system shall close the valve.

1.06 BIOSOLIDS DECANT PUMP STATION

A. The description of controls is for a duplex submersible pump station. Pump Station controls will via a Multitrode MultiSmart Pump Controller provided by the pump supplier and installed in the Biosolids Pump Station Control Panel (BCP). Data from the pump controller will be shared with the KISM/VT SCADA system via cellular modem for monitoring, indication, and alarming as listed in Appendix B – I/O List..

B. All level control set points and minimum/maximum variable frequency drive (VFD) speeds shall be coordinated with Engineer at time of pump station startup.

C. The pumps (BP1 and BP2) for the Biosolids Pump Station shall be controlled via a Multitrode MultiSmart Pump Controller with a primary radar level transmitter for continuous level and flow calculation. A redundant high-high level float will not be utilized at this pump station.

D. At the control panel pump control shall be selected at a local HAND-OFF-AUTO selector switch. Modes shall function as described below.

E. Sequence of Operation – Biosolids Decant Pump System:

1. Pump Control HAND-OFF-AUTO selector switch in "Auto" mode:
   a. Pumps (BP1 and BP2) shall be activated remotely through Operator input from the SCADA. An Operator will enter a speed (0-100%) and activate the pump station. The pump shall then ramp up to the entered speed and run at that speed until called to stop.

b. Regardless of level in the Biosolids Pump Station wet well, only one pump shall be allowed to run at a time. The active pump ("Lead" pump) shall alternate each time a pump is called to run by the Operator.
c. With "Lead" pump operating, the pump shall continue to run until the Operator manually calls the pump to stop, or if the low-level alarm is tripped.
d. With "Lead" pump operating, if the wet well level lowers to the Operator defined low level (based on radar-transmitter-determined wet well level), the pump shall be called to stop, and an alarm activated.

2. Pump Control HAND-OFF-AUTO selector switch in "Hand" mode: The selected pump shall be activated and ramped to a specific speed to allow the operator to bypass the pump controller and primary level transmitter to reduce the wet well liquid level for maintenance purposes. The pump(s) shall run continuously until the "Auto" or "Off" mode is selected by the operator.

3. Pump Control HAND-OFF-AUTO selector switch in "Off" mode: The pump is out of service and shall not operate. All alarms shall still activate in the "Off" position.

F. Required Alarming & Monitoring:

1. Local Pump Station Alarms & Monitoring: Individual alarms and monitoring in the pump station control enclosure (pilot lights on inner door of panel) shall be energized for the following:
a. Pump Running (each pump)
b. Pump Seal Leak / Pump Over-Temp (each pump: indicator lights on MiniCAS motor protection relay)
c. Variable Frequency Drive Fault (each pump)
d. Wet Well Low Level (pump controller output)

2. Station Alarms: The exterior station alarm light shall be energized by the following:
e. Wet Well Low Level (pump controller output)
f. Station Manual Test and Reset Pushbuttons
g. The exterior station alarm light shall be de-energized automatically when the alarm condition is cleared.

3. KISM/VT SCADA Remote Alarms & Monitoring: The alarms and monitoring points noted in Appendix B – I/O List shall be communicated remotely to the KISM/VT SCADA Monitoring System based on individual pump controller inputs and internal pump controller points via cellular communications gateway. The same alarms and monitoring points shall also be displayed on the pump controller keypad/display and resettable at the pump controller keypad/display.

4. All alarms shall remain activated until correction of alarm condition is completed.

1.07 AERATION SYSTEM

A. The existing aeration system for the north aeration basin will continue to be controlled by its existing control system and communicate existing signals and alarms to the KISM/VT SCADA system.

B. The proposed aeration system for the south aeration basin will be operated manually with air supply rate varied utilizing a manual inlet throttling valve. New signals will be available from the proposed air pressure transmitter, dissolved oxygen sensor/transmitter and the proposed total suspended solids

sensor/transmitter. The associated signals outlined in Appendix B – I/O List shall be communicated to the KISM/VT SCADA system and displayed and trended for operator use.

1.08 BIOSOLIDS AERATION SYSTEM

A. The proposed aeration system for the two biosolids basins will be operated via the KISM/VT SCADA system. Proposed surface aerators in the biosolids basins will be manually started and stopped by WWTF operators from the KISM/VT SCADA system. The associated signals outlined in Appendix B – I/O List shall be communicated to the KISM/VT SCADA system and displayed and trended for operator use.

1.09 EQUIPMENT RESTART AFTER POWER LOSS

A. Provide programming modifications to allow for sequencing the starting of major equipment upon a return to power on generator after a power loss and for return to utility power. Include each of four aeration blowers, four biosolids aerators, and three RAS pumps. Allow for operator selection of the order and time delay between each equipment item.

1.10 GRAPHIC SCREEN REQUIREMENTS

The following graphic screens shall be included in or added to the existing KISM/VT SCADA system. Graphics shall match existing screens used for similar Owner facilities when applicable. Equipment shall change color when running. Flow lines shall change color when there is flow through that line. Meters shall change color when there is flow through that meter. In addition, provide text readout for each device showing "OFF" or "ON", "OPEN" or "CLOSED" etc.

Provide an acknowledge button on the screen, and a function key which will shut off the audible alarm when acknowledged by the operator.

A. Modifications to Existing KISM/VT SCADA Screens
    a. Main Overview Screen
        i. Add Headworks building rectangle, with motor icons for the screen, grit paddle drive, grit pump, and classifier.
        ii. Add RAS4 and RAS5 pump. Match display and indication for existing RAS pumps.
        iii. Add Biosolids Pump Station rectangle with two motor icons for proposed pumps.
        iv. Alter Polishing Pond Pump Station rectangle with two motor icons for proposed pumps.
        v. Add air header pressure icon for South Aeration Basin Air Header
        vi. Correct Numbering of Blowers 1 to 4
    b. System Overview Screen
        i. Add Headworks icon before the Inlet/Splitter Box icon, re-route piping and labels as necessary. Show and label motors for screen, grit paddle drive, grit pump, and grit classifier in the Headworks icon.
        ii. Rename North Clarifier as Clarifier No. 1, South Clarifier as Clarifier No. 2 and Clarifier Room as North Clarifier Room
        iii. Add South Clarifier Room and Clarifier No. 3 with matching running indication.
        iv. Add RAS4 and RAS5 pump. Match display and indication for existing RAS pumps.
        v. Correct Numbering of Blowers 1 to 4
    c. Inlet/Splitter Box Screen
        i. Remove the grinder and bar screen icons from the Inlet/Splitter Box schematic.
        ii. Remove grinder failure signal display icon.

iii. Rename North and South Clarifier as Clarifier No. 1 and Clarifier No. 2, respectively.
iv. Add separate box showing flow from Aeration Basin Outlet to Clarifier No. 3.

d. Polishing Pond Screen
   i. Edit screen as necessary to reflect new pumps and new setpoints for replaced pump station.
e. Blower Overview Screen
   i. Change Blowers labeled Blower 1 and Blower 2 to be Blower 2 and Blower 3. Add Blower 1 to show indication of running and fault for the existing centrifugal (southmost) blower in the blower room.
f. Blower Room Screen
   i. Revise interior piping schematic to match proposed piping.
   ii. Rename "Air Header Press" to "North Air Header Press"
   iii. Add South Air Header Pressure, DO Probe 3 and TSS Probe 3 to right side display of probe signals.
   iv. Correct Numbering of Blowers 1 to 4
g. Sludge Pumps Screen
   i. Add ability to designate active RAS pumps and select target flow rate as a flow in MGD.
h. Lift Station Screens
   i. Verify and correct pump running indication functioning properly for all lift station pumps.
   ii. Provide indication of flow from a future meter at Griswold Lift Station
i. Runtimes Screen
   i. Remove grinder icon and associated runtimes.
   ii. Add headworks motors (screen, grit paddle drive, grit pump, grit classifier) and associated runtimes.
j. Setpoints Screen
   i. Add South Aeration Basin Air Header pressure icon and associated setpoints.

B. New KISM/VT SCADA Screens
   a. South Aeration Basin Blower Overview Screen
      i. Match layout of existing Blower Overview screen, with one blower. Display DO Probe 3, TSS Probe 3, and associated signals/alarms similar to existing Blower Overview Screen.
   b. Biosolids Pump Station Screen
      i. Match layout of existing lift station screens (Polk, Creeks, Plum, East Main, Griswold, Polishing Pond). Display associated signals and icons similar to existing screens.
   c. Biosolids Aerators Screen
      i. Show schematic of Biosolids ponds, with all motors shown and signals displayed.
      ii. Provide display of running status of each aerator motor.
      iii. Provide means for remotely starting and stopping aerator motors.
      iv. Provide indicators of all alarms similar to existing screens.
   d. Headworks Screen
      i. Show schematic of Headworks with all motors shown and signals displayed.
      ii. Provide display of NPW system pressure.
      iii. Provide indicators of all alarms similar to existing screens.
   e. Clarifier No. 3 Sludge Pumping
      i. Show schematic of RAS pump 4 and RAS Pump 5 similar to Blower Room Sludge Pumping Screen
      ii. Display Clarifier No. 3 RAS Flow
      iii. Provide indicators of all alarms similar to existing screens.
   f. Return to Power Sequence

i. Show list of Equipment and allow for selection of the order each is returned to service.
ii. Provide for user input of time delay between return to service of each piece of equipment (one time delay to be used for all).

C. New Headworks OIT Screens

Screens similar to above for the Headworks shall be provided at the Headworks OIT with local operational information and alarms displayed.

END OF SECTION 40 96 35

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CONTROL SYSTEM INPUTS & OUTPUTS SCHEDULE

Device Type / Instrument ID Tag	Description	PLC I/O				Cellular (Comm)	Log Runtime	Totalizer	Alarm	Indication	Comments
		DI	DO	AI	AO						
EXISTING MAIN CONTROL PANEL MCP											
East Aerator 1											
Running	Aerator Running	1					X			X	Dry Contact from MCC compartment **(connect to spare DI at MCP)**
RVSS Fault	RVSS Fault	1							X	X	Dry Contact from MCC compartment **(connect to spare DI at MCP)**
Remote Start/Stop	Start/Stop Control		1								Start/Stop Command to MCC compartment **(connect to spare DO at MCP)**
East Aerator 2											
Running	Aerator Running	1					X			X	Dry Contact from MCC compartment **(connect to spare DI at MCP)**
RVSS Fault	RVSS Fault	1							X	X	Dry Contact from MCC compartment **(connect to spare DI at MCP)**
Remote Start/Stop	Start/Stop Control		1								Start/Stop Command to MCC compartment **(connect to spare DO at MCP)**
West Aerator 1											
Running	Aerator Running	1					X			X	Dry Contact from MCC compartment **(connect to spare DI at MCP)**
RVSS Fault	RVSS Fault	1							X	X	Dry Contact from MCC compartment **(connect to spare DI at MCP)**
Remote Start/Stop	Start/Stop Control		1								Start/Stop Command to MCC compartment **(connect to spare DO at MCP)**
West Aerator 2											
Running	Aerator Running	1					X			X	Dry Contact from MCC compartment **(connect to spare DI at MCP)**
RVSS Fault	RVSS Fault	1							X	X	Dry Contact from MCC compartment **(connect to spare DI at MCP)**
Remote Start/Stop	Start/Stop Control		1								Start/Stop Command to MCC compartment **(connect to spare DO at MCP)**
South Aeration Basin											
AE-103A / AIT-103	Disolved Oxygen (DO)			1					X	X	4-20mA from DO/TSS analyzer/transmitter **(connect to spare AI at MCP)**
AE-103B / AIT-103	Total Suspended Solids (TSS)			1					X	X	4-20mA from DO/TSS analyzer/transmitter **(connect to spare AI at MCP)**
PIT-2	Aeration Process Air Pressure			1					X	X	4-20mA from transmitter (**connect to spare AI at MCP**)
RAS/WAS Control Valve No. 1 CV1											
Position Reference	Valve Position Reference				1					X	4-20mA to control valve **(connect to spare AO at MCP)**
Position Feedback	Valve Position Feedback			1						X	4-20mA from control vavle **(connect to spare AI at MCP)**
Ex. Return Activated Sludge Pump RAS1											
Running	Pump Running	1					X			X	Dry Contact from existing VFD Enclosure (**DI is existing at MCP, no work)**
VFD Fault	VFD Fault	1							X	X	Dry Contact from existing VFD Enclosure **(DI is existing at MCP, no work)**
VFD Speed Feedback	Speed Feedback			1						X	4-20mA speed feedback from exisitng VFD Enclosure **(AI is existing at MCP, no work)**
Remote Start/Stop	Start/Stop Control		1								120VAC power from TCP to energize start/stop relay at VFD **(connect to spare DO at MCP)**
VFD Speed Reference	Speed Reference				1					X	4-20mA speed control reference to exisitng VFD Enclosure **(provide new AO card at MCP)**
Ex. Return Activated Sludge Pump RAS2											
Running	Pump Running	1					X			X	Dry Contact from existing VFD Enclosure **(DI is existing at MCP, no work)**
VFD Fault	VFD Fault	1							X	X	Dry Contact from existing VFD Enclosure **(DI is existing at MCP, no work)**
VFD Speed Feedback	Speed Feedback			1						X	4-20mA speed feedback from exisitng VFD Enclosure **(AI is existing at MCP, no work)**
Remote Start/Stop	Start/Stop Control		1								120VAC power from TCP to energize start/stop relay at VFD **(connect to spare DO at MCP)**
VFD Speed Reference	Speed Reference				1					X	4-20mA speed control reference to exisitng VFD Enclosure **(provide new AO card at MCP)**
Ex. Return Activated Sludge Pump RAS3											
Running	Pump Running	1					X			X	Dry Contact from existing VFD Enclosure (**DI is existing at MCP, no work)**
VFD Fault	VFD Fault	1							X	X	Dry Contact from existing VFD Enclosure **(DI is existing at MCP, no work)**
VFD Speed Feedback	Speed Feedback			1						X	4-20mA speed feedback from exisitng VFD Enclosure **(AI is existing at MCP, no work)**
Remote Start/Stop	Start/Stop Control		1								120VAC power from TCP to energize start/stop relay at VFD **(connect to spare DO at MCP)**
VFD Speed Reference	Speed Reference				1					X	4-20mA speed control reference to exisitng VFD Enclosure **(provide new AO card at MCP)**
Alarms & Monitoring											
FE/FIT-1	Raw Wastewater Influent Flow			X				X		X	4-20mA flow signal from flow transmitter **(AI is existing at MCP, reconnect)**
FE/FIT-2	Return Activated Sludge Flow			X				X		X	4-20mA flow signal from flow transmitter **(AI is existing at MCP, reconnect)**
Polishing Pond Pump Station Control Panel											
Pump P1											
Running	Pump Running					X	X			X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Pump Failed to Run when Called	Pump Failed to Start Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Seal Leak	Pump Seal Leak Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry

CONTROL SYSTEM INPUTS & OUTPUTS SCHEDULE

Device Type / Instrument ID Tag	Description	PLC I/O				Cellular (Comm)	Log Runtime	Totalizer	Alarm	Indication	Comments
		DI	DO	AI	AO						
Motor Overtemp	Motor Overtemp Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Power & Current	Motor Power & Current Indication					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
VFD Fault	VFD Fault					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Pump P2											
Running	Pump Running					X	X			X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Pump Failed to Run when Called	Pump Failed to Start Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Seal Leak	Pump Seal Leak Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Overtemp	Motor Overtemp Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Power & Current	Motor Power & Current Indication					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
VFD Fault	VFD Fault					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Alarms & Monitoring											
Wet Well Low Level	Wet Well Low Level Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Wet Well High Level	Wet Well High Level Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Wet Well High High Float	Wet Well High High Level Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Backup Float Control Activated	Backup Float Control Activated Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
High High Lag Pump Running	High High Lag Pump Running Alarm					X				X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Phase Failure/Phase Loss	Phase Failure/Phase Loss Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Wet Well Level	Wet Well Level					X				X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Pump Controller Fault	Pump Controller Fault Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Loss of Primary Level Signal	Loss of Primary Level Signal Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Biosolids Pump Station Control Panel											
Pump P1											
Running	Pump Running					X	X			X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Pump Failed to Run when Called	Pump Failed to Start Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Seal Leak	Pump Seal Leak Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Overtemp	Motor Overtemp Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Power & Current	Motor Power & Current Indication					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
VFD Fault	VFD Fault					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Remote Start/Stop	VFD Remote Start/Stop Control					X					Soft Logic via cellular comminucation and MultiSmart pump controller registry
VFD Speed Control	VFD Remote Speed Setpoint					X					
Pump P2											
Running	Pump Running					X	X			X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Pump Failed to Run when Called	Pump Failed to Start Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Seal Leak	Pump Seal Leak Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Overtemp	Motor Overtemp Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Motor Power & Current	Motor Power & Current Indication					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
VFD Fault	VFD Fault Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Remote Start/Stop	VFD Remote Start/Stop Control					X					Soft Logic via cellular comminucation and MultiSmart pump controller registry
VFD Speed Control	VFD Remote Speed Setpoint					X					Soft Logic via cellular comminucation and MultiSmart pump controller registry
Alarms & Monitoring											
Wet Well Low Level	Wet Well Low Level Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Wet Well High Level	Wet Well High Level Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Phase Failure/Phase Loss	Phase Failure/Phase Loss Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Wet Well Level	Wet Well Level Indication					X				X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Pump Controller Fault	Pump Controller Fault Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry
Loss of Primary Level Signal	Loss of Primary Level Signal Alarm					X			X	X	Soft Logic via cellular comminucation and MultiSmart pump controller registry

CONTROL SYSTEM INPUTS & OUTPUTS SCHEDULE

Device Type / Instrument ID Tag	Description	PLC I/O				Cellular (Comm)	Log Runtime	Totalizer	Alarm	Indication	Comments
		DI	DO	AI	AO						
PROPOSED HEADWORKS CONTROL PANEL HCP											
Grit Control Panel (GCP)											
Grit Pump GP											
Running	Pump Running	1					X			X	Dry contact from Control Panel GCP
Motor Overtemp	Motor Overtemp Alarm	1							X	X	Dry contact from Control Panel GCP
Grit Classifier GC											
Running	Classifier Running	1					X			X	Dry contact from Control Panel GCP
Motor Overtemp	Motor Overtemp Alarm	1							X	X	Dry contact from Control Panel GCP
Grit Paddle Drive GPD											
Running	Paddle Drive Running	1					X			X	Dry contact from Control Panel GCP
Motor Overtemp	Motor Overtemp Alarm	1							X	X	Dry contact from Control Panel GCP
General											
E-Stop Pressed	Grit System E-Stop Alarm	1							X	X	Dry contact from Control Panel GCP
Rotary Drum Screen Control Panel (SCP)											
Screen SC											
Running	Screen Running	1					X			X	Dry contact from Control Panel SCP
Fault	Screen Fault	1							X	X	Dry contact from Control Panel SCP
General											
E-Stop Pressed	Screen System E-Stop Alarm	1							X	X	Dry contact from Control Panel SCP
Inlet Channel High Level	Screen Inlet Channel High Level	1							X	X	Dry contact from Control Panel SCP
Inlet Channel Level	Screen Inlet Channel Level			1						X	Level Transmitter 4-20mA loop from Control Panel SCP
HVAC Monitoring											
Exhaust Fan EF1											
In Auto	In Auto	1							X	X	Dry contact from exhaust fan starter
Not Running	Fan Not Running Alarm	1					X		X	X	Dry contact from exhaust fan starter / Trip air quality alarm lights AL1, AL2, AL3
Makeup Aur Unit MAU1											
In Auto	In Auto	1							X	X	Dry contact from makeup air unit controller
Not Running	MAU Not Running Alarm	1					X		X	X	Dry contact from makeup air unit controller / Trip air quality alarm lights AL1, AL2, AL3
Common Fault	Mau Common Fault	1							X	X	
Additional											
Influent Sampler	Influent Sampler				1					X	Sampler paced from 4-20mA signal from FE/FIT-1 Raw Wastewater Influent Flow Meter
AIT-201	H_2S Gas Monitor Level/Alarm			1					X	X	4-20mA signal from analyzer / Trip air quality alarm lights AL1, AL2, AL3, AL4
AIT-202	LEL Gas Monitor Level/Alarm			1					X	X	4-20mA signal from analyzer / Trip air quality alarm lights AL1, AL2, AL3, AL4
AIT-203	O_2 Monitor Level/Alarm			1					X	X	4-20mA signal from analyzer / Trip air quality alarm lights AL1, AL2, AL4
LSH-204	Rise Well Float High Level Alarm	1							X	X	Contact from Intrinsically Safe Relay provided in CPH
PSL-205	Low NPW Pressure Alarm	1							X	X	Dry contact from NPW pressure pressure switch on water pressure tank
Sump High Level	Sump High Level Alarm	1							X	X	Dry contact from Control Panel SPCP
NPW Pump VFD Fault	NPW Pump VFD Fault Alarm	1							X	X	Dry contact from NPW well pump VFD
Air Quality Alarm Lights AL1, AL2, AL3, AL4	Screen & Grit Room Air Quality Alarm		1							X	Energize all alarm lights on trip of AIT-201, 202 & 203

CONTROL SYSTEM INPUTS & OUTPUTS SCHEDULE

Device Type / Instrument ID Tag	Description	PLC I/O				Cellular (Comm)	Log Runtime	Totalizer	Alarm	Indication	Comments
		DI	DO	AI	AO						
PROPOSED TREATMENT BUILDING CONTROL PANEL TCP (NORTH CLARIFIER ROOM)											
Return Activated Sludge Pump RAS4											
Running	Pump Running	1					X			X	Dry Contact from VFD Enclosure
VFD Fault	VFD Fault	1							X	X	Dry Contact from VFD Enclosure
VFD Speed Feedback	Speed Feedback			1						X	4-20mA speed feedback from VFD Enclosure
Remote Start/Stop	Start/Stop Control		1								120VAC power from TCP to energize start/stop relay at VFD
VFD Speed Reference	Speed Reference				1					X	4-20mA speed control reference to VFD Enclosure
Return Activated Sludge Pump RAS5											
Running	Pump Running	1					X			X	Dry Contact from VFD Enclosure
VFD Fault	VFD Fault	1							X	X	Dry Contact from VFD Enclosure
VFD Speed Feedback	Speed Feedback			1						X	4-20mA speed feedback from VFD Enclosure
Remote Start/Stop	Start/Stop Control		1								120VAC power from TCP to energize start/stop relay at VFD
VFD Speed Reference	Speed Reference				1					X	4-20mA speed control reference to VFD Enclosure
Clarifier No. 3											
Running	Clarifier Running						X			X	Dry Contact from Clarifier Starter
Over-Torque Warning	Over-Torque Warning								X	X	Dry Contact from Clarifier Starter Over-Torque relay CR2
Over-Torque Shutdown	Over-Torque Shutdown								X	X	Dry Contact from Clarifier Starter Over-Torque relay CR1
Additional											
FE/FIT-4	RAS1 Pump Flow			1				X		X	4-20mA flow signal from flow transmitter
FE/FIT-5	RAS2 Pump Flow			1				X		X	4-20mA flow signal from flow transmitter
FE/FIT-6	RAS3 Pump Flow			1				X		X	4-20mA flow signal from flow transmitter
FE/FIT-7	RAS4 Pump/RAS5 Pump Flow			1				X		X	4-20mA flow signal from flow transmitter
LSH-C1	Clarifier No. 1 Scum Box High Level	1							X	X	Dry contact from float switch
LSH-C2	Clarifier No. 2 Scum Box High Level	1							X	X	Dry contact from float switch
LSH-C3	Clarifier No. 3 Scum Box High Level	1							X	X	Dry contact from float switch

CONTROL SYSTEM EXISTING IO DEMOLITION SCHEDULE

Device Type / Instrument ID Tag	Description	PLC I/O				IO POINT	Comments
		DI	DO	AI	AO		
EXISTING MAIN CONTROL PANEL MCP							
Ammonia Gas Detection Chem Area No. 1	Pilot Light on MCP Door		X			O:7/08	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Maintain non-isolated DO wiring (SPARE)
Ammonia Gas Detection Chem Area No. 2	Pilot Light on MCP Door		X			O:7/09	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Maintain non-isolated DO wiring (SPARE)
Grinder Alarm	Pilot Light on MCP Door		X			O:7/10	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Maintain non-isolated DO wiring (SPARE)
Blower No. 1 Alarm	Pilot Light on MCP Door		X			O:7/11	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Maintain non-isolated DO wiring (SPARE)
Blower No. 2 Alarm	Pilot Light on MCP Door		X			O:7/12	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Maintain non-isolated DO wiring (SPARE)
Blower No. 3 Alarm	Pilot Light on MCP Door		X			O:7/13	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Maintain non-isolated DO wiring (SPARE)
Blower No. 4 Alarm	Pilot Light on MCP Door		X			O:7/14	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Maintain non-isolated DO wiring (SPARE)
North Clarifier Alarm	Pilot Light on MCP Door		X			O:7/15	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Maintain non-isolated DO wiring (SPARE)
South Clarifier Alarm	Pilot Light on MCP Door		X			O:8/00	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Inlet/Splitter Box Alarm	Pilot Light on MCP Door		X			O:8/01	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Chem Area No. 1 Alarm	Pilot Light on MCP Door		X			O:8/02	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Chem Area No. 2 Alarm	Pilot Light on MCP Door		X			O:8/03	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Blower Room Alarm	Pilot Light on MCP Door		X			O:8/04	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Clarifier Room Alarm	Pilot Light on MCP Door		X			O:8/05	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Ammonia Hydroxide System Alarm	Pilot Light on MCP Door		X			O:8/06	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Phosphoric Acid System Alarm	Pilot Light on MCP Door		X			O:8/07	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Return Actvated Sludge Pump No. 1 Alarm	Pilot Light on MCP Door		X			O:8/08	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Return Actvated Sludge Pump No. 2 Alarm	Pilot Light on MCP Door		X			O:8/09	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Return Actvated Sludge Pump No. 3 Alarm	Pilot Light on MCP Door		X			O:8/10	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Waste Actvated Sludge Pump No. 1 Alarm	Pilot Light on MCP Door		X			O:8/11	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Waste Actvated Sludge Pump No. 2 Alarm	Pilot Light on MCP Door		X			O:8/12	Demo pilot light and wiring to terminal strip. Remove DO logic and maintain SCADA Alarm. Convert DO to isolated wiring (SPARE)
Grinder Running	From Inlet Splitter Box Grinder CP	X				I:03/08	Remove DI logic and SCADA indication and graphics (SPARE)
Grinder Fault	From Inlet Splitter Box Grinder CP	X				I:03/08	Remove DI logic and SCADA indication and graphics (SPARE)

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PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT

DIVISION 43

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SECTION 43 21 13.20
RETURN ACTIVATED SLUDGE PUMPS

PART 1 - GENERAL

1.01 SCOPE

Work includes provision, installation and placing into operation two (2) horizontal, factory-built base mounted, self-priming return activated sludge (RAS) pumps as shown in the Drawings and as specified in this Section.

The Contractor shall be responsible to coordinate all details of the installation of specified equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible.

RAS pumps shall be as manufactured by Gorman-Rupp, or Engineer approved equal.

1.02 REFERENCES

A. Publications listed below form part of this specification to extent referenced in the text by basic designation only. Consult latest edition of publication unless otherwise noted.

1. American National Std. Institute (ANSI) / American Water Works Assoc. (AWWA)
   a. ANSI B16.1 Cast iron pipe flanges and flanged fittings.
   b. ANSI/AWWA C115/A21.51 Cast/ductile iron pipe with threaded flanges.
   c. ANSI 253.1 Safety Color Code for Marking Physical Hazards.
   d. ANSI B40.1 Gages, Pressure and Vacuum.

2. American Society for Testing and Materials (ASTM)
   a. ASTM A48 Gray Iron Castings.
   b. ASTM A307 Carbon Steel Bolts and Studs.
   c. ASTM A36 Structural Steel.

3. Institute of Electrical and Electronics Engineers (IEEE)
   a. ANSI/IEEE Std 100 Standard Dictionary of Electrical Terms.
   b. ANSI/IEEE Std 112 Test Procedure for Polyphase Induction Motors.
   c. IEEE Std 242 Protection of Industrial and Control Power Systems.

4. National Electric Code (NEC) / National Electrical Manufacturers Assoc. (NEMA)
   a. NEC National Electric Code.
   b. NEC 701 National Electric Code article 701.
   c. NEMA Std MG1 Motors and Generators.

5. Miscellaneous References
   a. Ten-State Standards Recommended Standards for Sewage Works.
   b. Hydraulic Institute Std for Centrifugal, Rotary and Reciprocating Pumps.
   c. NMTBA and JIC Std National Machine Tool Builders Association and Joint Industrial Council Standards
   d. ISO 9001 International Organization for Standardization.

1.03 SYSTEM DESCRIPTION

A. Contractor shall furnish and install one factory built base mounted pump with motor. The pump equipment shall be complete with all equipment specified herein, factory assembled on a steel base.

B. Principal items of pump equipment shall include a horizontal, self priming, centrifugal sewage pump, direct coupled motor and coupling guard on a steel base in accordance with requirements listed under PART 2 - PRODUCTS of this section.

1.04 PERFORMANCE CRITERIA

A. Pumps must be designed to handle raw, unscreened, domestic sanitary sewage. Pumps shall have 6" suction connection, and 6" discharge connection. Each pump shall be selected to perform under following operating conditions:

1.	Pump Model	T6C60SC-B
2.	Capacity (GPM)	730 gpm
3.	Total Dynamic Head (FT)	44’ TDH
4.	Total Dynamic Suction Lift (FT)	18’
5.	Maximum Repriming Lift (FT)	12’ @ 850 RPM, 21’ @ 1,150 RPM
6.	Maximum Static Suction Lift (FT)	12’
7.	Total Discharge Static Head (FT)	8’
8.	Impeller Diameter	12.38”

B. Site power furnished to pump station shall be 3 phase, 60 hertz, 460 volts, maintained within industry standards.

1.05 SUBMITTALS

A. Product Data

1. Prior to fabrication, pump manufacturer shall submit data for review and approval.

2. Submittal shall include shop drawings and support data as follows: Catalog cuts sheets reflecting characteristics for major items of equipment, materials of construction, major dimensions, motor and motor coupling data, pump characteristic curves showing the design duty point capacity (GPM), head (FT), net positive suction head required (NPSHr), and hydraulic brake horsepower (BHP).

B. Shop drawings shall provide layout of pump equipment and anchor bolt locations for steel base. Contractor piping connections and pump access clearances shall be dimensioned.

C. Operations Maintenance Manuals

1. Installation shall be in accordance with written instructions provided by the pump manufacturer. Comprehensive instructions supplied at time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps and motors, but lack experience on exact equipment supplied.

2. Documentation shall be specific to the pump equipment supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of pump equipment supplied by the pump manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall station design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:

a. Functional description of each major component, complete with operating instructions.

b. Instructions for operating pumps.

c. Calibration and adjustment of equipment for initial start-up or as required for routine maintenance.

d. Mechanical layout drawing of the pump, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps and motors.

3. Operation and maintenance instructions which rely on vendor cut-sheets and literature which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.

1.06 QUALITY ASSURANCE

A. The pump manufacturer must be ISO 9001:2008 revision certified, with scope of registration including design control and service after sales activities.

B. The pump manufacturer must be registered to the ISO 14001 Environmental Management System standard and as such is committed to minimizing the impact of its activities on the environment and promoting environmental sustainability by the use of best management practices, technological advances, promoting environmental awareness and continual improvement.

C. Manufacturer must show proof of original product design and testing. Products violating intellectual property regulations shall not be allowed, as they may violate international law and expose the user or engineer to unintended liabilities. "Reverse-engineered" products fabricated to substantially duplicate the design of original product shall not be allowed, as they may contain substantial differences in tolerances and material applications addressed in the original design, which may contribute to product failure.

D. The term "pump manufacturer" shall be defined as the entity which designs, machines, assembles, hydraulically tests and warranties the final product. Any entity that does not meet this definition will not be considered a "pump manufacturer" and is not an acceptable supplier. For quality control reasons and future pump and parts availability, all major castings of the pump shall be sourced and machined in North America.

E. Pump Performance Certifications

1. Solids Handling Capability

a. All internal passages, impeller vanes, and recirculation ports shall pass a 3" spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with priming and pump performance shall not be permitted. Upon request from the engineer, manufacturer's certified drawings showing size and location of the recirculation port(s) shall be submitted for approval.

F. Reprime Performance

1. Consideration shall be given to the sanitary sewage service anticipated, in which debris is expected to lodge between the suction check valve and its seat, resulting in the loss of the pump suction leg, and siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal, and the pump must be capable of automatic, unattended operation with an air release line installed.

2. During unattended operation, the pump shall retain adequate liquid in the casing to insure automatic repriming while operating at its rated speed in a completely open system. The need for a suction check valve or external priming device shall not be required.

3. Pump must reprime 12' OR 21' vertical ft. at the specified speed and impeller diameter noted in section 1.04 above. Reprime lift is defined as the static height of the pump suction above the liquid, while operating with only one-half of the liquid remaining in the

pump casing. The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition.

G. The manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, and instruct operating personnel in the proper operation and maintenance of the equipment as described in Part 3 of this section.

1.07 MANUFACTURER'S WARRANTY

A. The pump manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.

1. Pump equipment, apparatus, and parts furnished shall be warranted for sixty (60) months, excepting only those items that are normally consumed in service, such as V-Belts (if applicable), oils, grease, packing, gaskets, O rings, etc. The pump manufacturer shall be solely responsible for warranty of the station and all components.

B. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer.

C. It is not intended that the pump manufacturer assume liability for consequential damages or contingent liabilities arising from failure of any vendor supplied product or part which fails to properly operate, however caused. Consequential damages resulting from defects in design, or delays in delivery are also beyond the manufacturer's scope of liability.

D. Equipment supplied by others and incorporated with the pump equipment is not covered by this limited warranty. Any warranty applicable to equipment selected or supplied by others will be limited solely to the warranty, if any, provided by the manufacturer of the equipment.

E. This limited warranty shall be valid only when installation is made and use and maintenance is performed in accordance with manufacturer recommendations. A start-up report competed by an authorized manufacturer's representative must be received by manufacturer within thirty (30) days of the initial date the unit is placed into service. The warranty shall become effective on the date of acceptance by the purchaser or the purchaser's authorized agent, or sixty (60) days after installation, or ninety (90) days after shipment from the factory, whichever occurs first.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. The pump manufacturer must be ISO 9001:2008 revision certified, with scope of registration including design control and service after sales activities.

B. The pump equipment shall be manufactured by the Gorman-Rupp Company, or Engineer-approved equal.

2.02 PUMP DESIGN

A. Pump shall be horizontal, self-priming centrifugal type, designed specifically for handling raw, unscreened, domestic sanitary sewage. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under PART 1 - GENERAL of this section.

B. The pump manufacturer must be ISO 9001:2008 revision certified, with scope of registration including design control and service after sales activities.

C. Materials and Construction Features

1. Pump casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:

   a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.

   b. Fill port coverplate, 3 1/2" diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, hand nut threads must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.

   c. Casing drain plug shall be at least 1 1/4" NPT to insure complete and rapid draining.

   d. Liquid volume and recirculation port design shall be consistent with performance criteria listed under PART 1 - GENERAL of this section.

2. Coverplate assembly shall be cast iron Class 30. Design must incorporate following maintenance features:

   a. A lightweight inspection coverplate, retained by acorn nuts, for access to pump interior for removal of stoppages. Designs that require removal of complete coverplate assembly for access to the impeller will not be accepted.

   b. Retained by acorn nuts for complete access to pump interior. Back coverplate removal must allow service to the impeller, seal, wear plate or check valve without removing suction or discharge piping. Back coverplate shall incorporate an obstruction free flow path by combining four support posts into a two-point “webbed” plate design for increased durability, reduced clogging, and increased operational efficiency.

   c. Aggressive Self-Cleaning Wear Plate

      1) A replaceable wear plate secured to the back cover plate by studs and nuts. Wear plate shall be self-cleaning design ensuring that debris is cleared away and does not collect on the impeller vanes.

      2) The nature of the conveyed medium poses significant challenges to the continuous operation of the pump. Of particular concern is the clogging of the impeller by debris in the pumped medium including but not limited to long rags, fibers, and like debris which are able to wrap around the impeller vanes, stick to the center of the vanes or hub, or lodge within the spaces between the impeller and the housing.

      3) The aggressive self-cleaning wear plate shall have integral laser cut notches and grooves in combination with a “tooth” designed to disturb and dislodge any solids which might otherwise remain on the impeller in dynamic operation. Wear plate is designed to constantly and effectively clear the eye of the impeller without the use of blades or cutters.

   d. In consideration for safety, a pressure relief valve shall be supplied in the inspection coverplate. Relief valve shall open at 75-200 PSI.

e. One O-ring of Buna-N material shall seal inspection coverplate to back coverplate.

f. Two O-rings of Buna-N material shall seal back coverplate to pump casing.

g. Pusher bolt capability to assist in removal of inspection coverplate or back coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.

h. Easy-grip handle shall be mounted to face of inspection coverplate.

3. Rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, seal plate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate following features:

a. Seal plate and bearing housing shall be cast iron Class 30. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.

1) The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.

2) The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.

3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

b. Impeller shall be ductile iron, two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lockscrew and conical washer.

c. Shaft shall be AISI 4140 alloy steel unless otherwise specified by the engineer, in which case AISI 17-4 pH stainless steel shall be supplied.

d. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

e. Shaft seal shall be cartridge oil lubricated mechanical type. The stationary and rotating seal faces shall be tungsten titanium carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring secures the stationary seat to the seal plate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be viton; cage and spring to be stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings. Seal shall be warranted in accordance with requirements listed under PART 1 - GENERAL of this section.

f. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

4. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.

a. Clearances shall be maintained by a four point external shimless coverplate adjustment system, utilizing a four collar and four adjusting screw design allowing for incremental adjustment of clearances by hand as required. Each of the four points shall be lockable to prevent inadvertent clearance increases or decreases due to equipment vibration or accidental operator contact. The four point system also allows for equal clearance gaps at all points between the impeller and wear plate. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings. Clearance adjustment systems that utilize less than four points will not be considered.

b. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above

c. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

D. Serviceability

1. No special tools shall be required for replacement of any components within the pump.

E. Pumps to be supplied with a drain kit for ease of maintenance. The kit shall contain 10' length of reinforced plastic hose with a female quick connect fitting at one end, and factory installed drain fittings in each pump. Fittings include a stainless steel pipe nipple, stainless steel bushing, stainless steel ball valve and aluminum male quick connect fitting.

F. The following minimum spare parts shall be furnished with the pump station:

1. One pump mechanical seal

2. Required cover plate O-Ring(s)

3. One rotating assembly O-Ring(s)

4. One set of impeller clearance adjustment spacers

G. The pump and motor base shall be made of fabricated steel and designed to support the full weight of the pump and motor under normal operating conditions. Pump base configuration as shown on the Drawings.

2.03 DRIVE UNIT

A. The pump and motor base shall be made of fabricated steel and designed to support the full weight of the pump and motor under normal operating conditions. Pump base configuration as shown on the Drawings.

B. Drive Transmission

1. Power to pumps transmitted by a direct coupled motor. Motor to pump connection is made via a flexible coupling.

2. Coupling Guards

a. Pump drives to be enclosed on all sides by a guard constructed of fabricated steel or combination of materials including expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed 1/2 inch.

b. Guards must be completely removal without interference from any unit component, and shall be securely fastened and braced to the unit base.

c. Metal to be free from burrs and sharp edges. Structural joints shall be continuously welded. Rivet spacing on panels shall not exceed five inches. Tack welds shall not exceed four inch spacing.

d. The guard shall be finished with one coat of gray W.R. non lift primer and one coat of orange acrylic alkyd W.R. enamel in accordance with section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Pump manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect complete pump unit and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

3.02 INSTALLATION

A. Install, level, align, and lubricate pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. Suction pipe connections are vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.

C. Check motor data plate for compatibility to site voltage. Install and test the motor ground prior to connecting line voltage to the motor.

D. Prior to applying electrical power to the motor, check all wiring for tight connection. Verify line voltage, phase sequence and ground before actual start-up.

3.03 FIELD QUALITY CONTROL

A. Operational Test

1. Prior to acceptance by owner, an operational test of all pumps and motors shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically,

structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

2. After construction debris and foreign material has been removed, contractor shall supply clear water volume adequate to operate pump. Observe and record operation of pumps, suction and discharge gage readings and ampere draw. Be alert to any undue noise, vibration or other operational problems.

B. Manufacturer's Start-Up Services

1. Coordinate station start-up with manufacturer's technical representative. The representative or factory service technician will inspect the completed installation. He will calibrate and adjust instrumentation, correct or supervise correction of defects or malfunctions, and instruct operating personnel in proper operation and maintenance procedures.

3.04 CLEANING

A. Prior to acceptance, inspect interior and exterior of pump for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.

3.05 PROTECTION

A. The pump equipment should be placed into service immediately. If operation is delayed, drain water from pumps and piping. Open motor circuit breakers and protect pump equipment from cold and moisture. Pump equipment is to be stored and maintained per manufacturer's written instructions.

END OF SECTION

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WATER AND WASTEWATER EQUIPMENT

DIVISION 46

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PART 1 - GENERAL

1.01 SCOPE:

A. In the proposed Headworks Building, furnish, install and place into operation one (1) rotating perforated plate screen for removing floating, particulate and fibrous material and for conveying, washing, dewatering and compacting the screenings before discharging the material via chute into a dumpster as shown on the Drawings and described in the herein.

B. Each screen shall include perforated plate basket, screw, drive motors, gear reducers, support leg, basket cover, anchor bolts, controls, chute and all accessories and appurtenances specified or otherwise required for a complete and properly operating installation.

C. Equipment shall be installed with a pivoting support structure to allow lifting of the screen basket above floor level. Also furnish and install any associated auxiliary equipment or accessories to be installed in the location as indicated on the Drawings and as specified herein.

D. All equipment supplied under this section shall be furnished by or through a single Screening System Supplier who shall coordinate with the Contractor, the design, fabrication, delivery, installation and testing of the screening components. The Screening System Supplier shall have the sole responsibility for the coordination and performance of all components of the screenings system with the performance and design criteria specified herein.

E. The Contractor shall be responsible to coordinate all details of the screening equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. The Contractor shall be responsible for all structural and other alterations in the Work required to accommodate the equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

F. Base bid equipment shall be Rotamat Perforated Plate Screen, RPPS 1400/3 as manufactured by Huber Technology, Inc. Acceptable alternate equipment includes Lakeside Raptor Rotating Drum Screen, or Engineer approved equal. Alternate equipment shall meet the requirements for alternate equipment as specified Section 01 61 00 Materials and Equipment, including but not limited to structural changes in the screen channel.

1.02 RELATED SECTIONS:

The following list of related sections is provided for the convenience of the Contractor and is for reference only to support commonly referenced sections that are in-general applicable to all equipment supplied. (For complete list of sections see specification index.)

1. Division 1
2. Section 09 96 00- High Performance Coatings
3. Division 26 Electrical

1.03 REFERENCE STANDARDS:

A. American Society for Testing and Materials (ASTM) Publications:

1. Section A322: Carbon and Alloy Steel Bar Specifications.
2. Section A507-10: Standard Specification for Drawing Alloy Steel, Sheet and Strip, Hot- Rolled and Cold Rolled

B. International Organization for Standardization (ISO) Publications:

1. ISO 281:2007 Calculation Method for Fatigue Lift for Roller Bearings

C. American Institute of Steel Construction (AISC) Publications

D. American Welding Society (AWS), European Welding Federation (EWF), and International Institute of Welding (IIW) Publications

E. American Structures Painting Council (ASPC) Publications

1.04 SUBMITTALS:

A. Submit in accordance with the General and Supplementary Conditions and Section 01 33 00.

B. Submit detailed shop and installation drawings to the Engineer for review for all screening equipment and accessories.

C. General Arrangement drawings that illustrate the layout of the equipment, equipment weight, lifting points, principal dimensions with related verifications required for installation including anchorage locations. Wiring and schematic drawings and other related data including descriptive literature, Electrical Control Drawings, Catalog Cut Sheets for individual components, gear reducer data, and Drive Motor Data.

D. Detailed installation instructions, with clear step-by-step points on the correct mechanical and electrical installation procedures.

E. Manufacturer's warranty information.

F. Operation & Maintenance Manuals including As-Built Drawings of the rotating drum screen, controls and accessories shall be provided in digital format after equipment ship for inclusion in the Operation and Maintenance manual specified in Section 01 33 00.

1.05 QUALIFICATION REQUIREMENTS:

A. These plans and specifications have been prepared on the basis of using equipment as listed as base bid. The proposal allows for other suppliers with an appropriate deduct or add for other equipment. All cost associated with utilizing equipment provided by other Manufacturers shall be included in the add or deduct including all building, electrical, mechanical or any other changes necessary to install the equipment. Alternate suppliers will be considered for approval in accordance with Section 01 61 00 Materials and Equipment.

B. The Contractor shall provide data on alternate equipment manufacturer's experience. Only equipment of those Manufacturers with 15 or more years of experience who have furnished like equipment and specialties for at least five similar plants that have been in regular operation not less than two years will be considered. Evidence of experience and operational data may be required from the manufacturer to determine the suitability and efficiency of the equipment offered.

C. The screen shall be fully assembled and shop tested at the manufacturing facility prior to shipment. Shop testing shall include a minimum of 4 hours of run time.

1.06 OPERATIONAL REQUIREMENTS:

A. System Operation Requirements: The screen system shall be capable of screening an average wastewater flow of 1.0 mgd and a peak flow of 4.0 mgd. Controls shall be provided for the screen specified herein and the integral screenings washing and compacting equipment.

B. The screen shall be capable of being rotated up out of the screen channel on a permanent hinged support for maintenance.

PART 2 - PRODUCTS

2.01 GENERAL:

A. The entire unit shall be manufactured from AISI 304L stainless steel shapes. All components made of stainless steel shall be passivated by full submergence in a pickling bath, or via a two-step bead blast and chelant passivation process for perfect surface finishing. Stainless steel components shall be fabricated and assembled in a factory where only stainless steel products are also fabricated, in order to prevent contamination by foreign debris which can cause corrosion of stainless steel. Fabrication and assembly in an area dedicated to construction of stainless steel equipment only is also acceptable.

B. Electric motors, gear reducers, and other self-contained or enclosed components shall have an acrylic enamel finish.

C. All stainless steel parts of the unit shall be fully submerged into a pickling bath for at least 8 hours to remove welding spots and to protect the stainless steel against corrosion. Bead blasting followed by a chelant passivation process per ASTM A-967 is also acceptable.

D. Fabrication shall be done in compliance with all applicable ASTM standards or equivalent international standards.

E. All welding in the factory shall use shielded arc, inert gas, MIG or TIG method. Filler wire shall be added to all welds to provide for a cross section equal to or greater than the parent metal. Buttwelds shall fully penetrate to the interior surface and gas shielding to interior and exterior of the joint shall be provided.

F. Bolts, nuts and washers shall be selected from AISI 304L or 316L stainless steel such that they are anti-seizing.

G. All welding shall be performed in accordance with American Welding Society (AWS) D1.1 Structural Welding Code, or equivalent.

2.02 PERFORMANCE REQUIREMENTS:

A. Screen Design Summary

1.	Number of screens	1
2.	Nominal screen basket diameter	55" (1440mm)
3.	Average flow per screen, MGD	1.0
4.	Max. Waste water flow per screen, MGD	4.0
5.	Max. Clean water flow per screen MGD	5.6
6.	Max. Upstream water level, inches	35.7
7.	Max. Wet screenings capacity, cfph	133
8.	Channel width, inch	55
9.	Channel depth, inch	54
10.	Discharge height from top of channel, inch	As drawn
11.	Perforated Plate Opening Size	1/4" (6mm)
12.	Location rating	Class 1, Division 1

B. The screen shall be designed to handle the maximum flow with the maximum upstream and downstream liquid levels as specified above.

C. The screen opening size specified above shall be the width of the circular perforated plate

opening.

D. The average perforation flow through velocity shall not exceed 3.3 ft/sec (1.0 m/sec) under any flow condition up to the maximum clean water flow specified above. The screen design shall minimize solids deposits in the channel.

E. The screen shall be capable of processing spherical objects with a diameter of 3-1/8". Such objects shall be conveyed through the auger and shall be discharged with the screenings. The unit shall be capable of processing the screenings load specified above.

F. The perforated plate screen shall consist of a rotating cylindrical screen with an integral screw conveyor and screenings press. The screen shall use a single drive for screening, conveying, dewatering and compressing the screening material. The screen shall have an inclination of 35 degrees.

G. Operation of the rotating screen shall be automatically initiated at a preset high upstream liquid level. Screens which operate continuously or via timer only will not be acceptable. The rotating basket shall remove solids from the flow and deposit them into the concentric screw conveyor hopper using a spray bar and basket cleaning brush providing positive cleaning of the screen basket surface. The screenings shall be transported up the screw conveyor, through an integrated screening washing system, a compaction and dewatering zone and then shall be discharged into a discharge chute.

H. All open spaces of the screen shall be positively cleaned via a spraybar and cleaning brush system. Screens using a rotating rake or only screw flights with brushes will not be acceptable.

I. The screening equipment shall produce dewatered screenings capable of passing the EPA Paint Filter Test as described in method 9095 of EPA Publication SW-486.

J. To minimize odors and nuisance, the conveyance, dewatering and compaction zones shall be completely enclosed.

K. The spray wash system shall be enclosed such that spray water, aerosols or leakage do not contaminate the operating floor.

L. The control system shall be designed such that the cleaning characteristics of the screen and wash system can be changed via the programmable controller.

M. MATERIALS

1. Unless otherwise specified in these specifications, the entire equipment shall be manufactured from AISI 304L austenitic stainless steel shapes (rods, angles, and channels), pipes, and sheets. All mechanical parts shall be designed to handle the forces that may be exerted on the unit during fabrication, shipping, erection, and proper operation according to the O&M manual.

2. The entire equipment shall be manufactured in a stainless steel only factory, or an area dedicated to stainless steel equipment manufacturing only to prevent contamination of the stainless steel with foreign contaminants.

3. The equipment, after its fabrication, shall undergo a passivation (pickling) process to ensure maximum resistance to corrosion. All stainless steel components and structures shall be passivated via full submergence in a pickling bath, or via a two-step bead blasting and chelant chemical passivation process.

2.03 PRODUCT DESIGN SPECIFICATIONS:

A. SCREEN:

1. The perforated plate screen shall be designed and built to withstand static and hydraulic forces exerted by the liquid to the screen. All structural and functional parts shall be sized for the loads encountered during the screening, conveying and pressing operations. All submerged components and all components of the rotary screen in contact with the screened solids shall be of stainless steel construction.

2. The screen basket shall be of a cylindrical shape. The perforated plate shall be around the entire basket circumference.

3. The upper end of the basket shall incorporate a support ring which shall be machined and supported by four (4) guide rollers made of polyamide. The guide rollers shall be attached to an upper support plate. This plate shall match a flange that is attached to the auger tube to ensure proper alignment of the basket. A brush shall be clamped to the upper support plate sealing the gap between the rotating screen basket and the fixed upper support plate.

4. The lower support ring of the basket shall be connected to the shaft of the auger and be driven by a common drive with the auger. The basket shall be connected with a solid support arm at the lower end of the basket which is bolted to the auger shaft.

5. A seal plate shall be provided between the circular screen and the channel. The seal plate shall be one-piece fabricated of stainless steel plate. The sealing plate shall be of sufficient height to prevent bypassing of flow around the screen at the maximum screen hydraulic capacity. A brush or neoprene corded seal shall be clamped to the seal plate sealing the gap between the fixed seal plate and the rotating screen basket.

6. The screen shall be provided with a support stand allowing for easy removal of the screen basket from the channel for maintenance purposes. The support stand shall be fabricated from stainless steel.

7. The screen shall be provided with a stainless steel housing of four wall plates and a cover. The housing shall be made of 5/64 inch thick stainless steel plate. The cover shall be made of 0.06 inch thick plate. The cover shall be removable and shall be secured with turn-locks.

B. CLEANING BRUSHES:

1. The screen basket shall rotate in one direction and pass through the topmost position where it is cleaned with a stainless steel high pressure spray bar and a stainless steel backed nylon brush with bristles that penetrate the depth of the perforated plate screen to ensure positive screenings removal. Brush bristles shall be high-strength nylon for superior life.

2. The brush shall be designed to ensure cleaning of the spaces to the full depth of the perforated plate. The cleaning brush shall be mounted upon a stainless steel holding device which keeps the brush in constant contact with the basket and shall be adjustable to allow for brush wear.

3. Another stainless steel backed nylon brush shall be attached to the rotating basket and positioned to make contact with the screening trough to sweep material caught on the edges of the trough.

C. BASKET COVER:

1. Screen backet cover shall be provided by the manufacturer and shall be mounted using manufacturer supplied equipment. Basket cover shall be installed per manufacturer recommendations.

D. SCREENINGS CONVEYOR AND SCREENINGS WASH-PRESS:

1. The auger tube shall have a diameter of 14 inches. The auger tube shall incorporate three (3) anti-rotation bars which shall be welded to the inside of the transport tube along the longitudinal axis. The screw shall not be in contact with the anti-rotation bars during normal operation, the screw shaft shall be supported by a Teflon® lined bronze slide bearing, or a polymeric composite sleeve bearing at the bottom and the gear box at the top.

2. A support flange with a minimum thickness of 0.75 inches shall be welded to the screenings transport tube. The screen basket rollers and the screenings collection hopper shall be attached to this plate.

3. A gear box support flange with a minimum thickness of 0.5 inches shall be welded to the upper end of the screenings transport tube for attachment of the drive assembly.

4. A shafted auger screw that is entirely made of stainless steel shall be provided to transport and dewater the screened material. A shaft-less screw shall not be acceptable. Screw flights shall be of decreasing pitch approaching the compaction zone to provide a mechanical compressing action on the screenings material. The shaft shall have a diameter of 4.5 inches and shall have flights with a minimum thickness of 0.188 inches in the transport zone and 0.375 inches in the compaction zone. A replaceable flight section with an angle of about 120 degrees that is bolted to the shaft shall be provided at the bottom of the shaft where the wear is highest.

5. A compaction zone shall be an integral part of the screenings screw conveyor and transport tube design. The compaction zone shall be designed to form a screenings plug of material and to return water released from the screened material back to the wastewater channel/pump sump through circular holes that are machined into the screenings transport tube.

6. The auger shaft shall be fitted with an upper and a lower solid stub. Stubs and screw shaft shall be accurately machined and shrink-fitted.

7. The lower end of the screenings conveyor shall be supported by a sealed, self-lubricated, Teflon lined bronze slide bearing, or a polymeric composite sleeve bearing. This bearing shall not take any thrust load from the screw conveyor. Lower ball or roller bearings, or bearings requiring lubrication, shall not be acceptable.

8. The lower bearing shaft and arm shall be designed to minimize material wrapping around the shaft. A seal plate shall be furnished to mate between the stationary lower bearing support and the rotating arm to prevent material intrusion into the bearing seals.

9. A compaction zone shall be provided as an integral part of the screw conveyor and tube. The compaction zone shall be designed to form a plug of screenings material and to return water released from the screened material back to the channel through perforations that are machined into the screenings transport tube.

10. The compaction zone shall be provided with split FRP or Type 304 stainless steel housing, furnished with gaskets and bolts, and easily removable for access. Designs requiring removal of the drive assembly, discharge head, or screw conveyor to gain access to the compaction zone will not be acceptable. The housing shall be provided

with a drain connection at its lowest point and a clamped flexible PVC hose for drain water whose other end is connected to a connection through the screen basket's upper support flange to return the drain water into the screen basket. The housing shall also be provided with a flush connection.

E. DRIVE:

1. The basket mechanism and transport screw shall be driven by a shaft mounted geared motor. The geared motor shall have a minimum service factor of 1.0. The motor shall be provided with thermostats to provide thermal overload protection in addition to current overload protection.

2. The gear reducer shall be bolted to a machined flange welded to the upper end of the transport tube.

3. The gear reducer shall be driven by a 3 phase, 60 Hertz, 230/460 volt, Class 1, Division 1, Group D inverter-duty, totally-enclosed, fan-cooled motor. The motor rating shall be a minimum of 2.0hp.

F. SPRAY WASH SYSTEMS

1. The screen shall be designed for a water supply of 46 gpm and shall be provided with washwater distribution manifold with a single 1.5 inch point for connecting to the non-potable well water supply.

2. An automatic spray wash system shall be provided for cleaning of the screen basket and shall be constructed of minimum 1.25 inch diameter piping and minimum 1.25 inch diameter flexible reinforced PVC hose. The spray wash systems shall be operated only while the screen basket is rotating. The spray wash system shall include a single 1.25 inch solenoid valve for flow control. Minimum pressure to the spray wash shall be 75 psi (5 bar).

3. The screen shall incorporate a screenings washing system (IRGA) consisting of two washing points, one being in the rising tube of the screen and the second being in the screenings collection hopper. The screenings wash zone in the conveyor tube shall be provided with three nozzles located equidistant around the circumference to maximize the washing performance. A lower wash system shall be located above the open top of the hopper and shall utilize a spray bar with a minimum of 2 spray nozzles. The screenings washing system shall include dual 1 inch solenoid valves for flow control.

4. The screen compaction zone shall be provided with a wash nozzle designed to flush the entire interior surface of compaction zone housing to ensure no debris buildup can occur. The compaction zone flushing system shall include a single 1 inch solenoid valve for flow control.

5. The solenoid valves shall be operated by the programmable logical controller. Individual manual operation of each solenoid shall also be possible from the control panel.

6. The solenoid valves shall be minimum 1 inch diameter, brass body, 2-way, and designed for 110 VAC with Class I, Division I, Group D rating. Solenoid valves shall be normally closed and rated for up to 100 psig.

7. A brass body Y-strainer shall be provided for the incoming water supply.

G. CHUTE

1. Equipment manufacturer shall furnish custom stainless steel chute to convey compacted screenings to the dumpster provided by others. Chute design shall be such that screenings discharge by gravity to elevation of dumpster height as shown on the Drawings. Chute shall be fully enclosed and shall have internal access for maintenance. Chute shall be provided with wall mounted support(s) as necessary. Supports shall be mounted with clearance above finish floor elevation as shown on the Drawings.

H. ANCHOR BOLTS

1. Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. Anchor bolts, hex nuts, and washers shall be stainless steel. Anchor bolts shall be wedge or epoxy type.

2. Anchor bolts shall be set by the Contractor. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

I. CONTROL SYSTEM

1. All controls necessary for the fully automatic operation of the screen shall be provided, including a NEMA 12 main control panel, and a NEMA 7 local control station.

2. The electrical control system shall provide for automatic control of the screen via a high liquid level using an ultrasonic level sensor appropriate for a Class I, Division I environment in combination with an adjustable timer. Operation of the screen shall be automatically initiated at an operator set upstream liquid level. Operator shall also be able to select operation based on a pre-determined time sequence.

3. Screen control panel shall include an adjustable 0 to 5 minute delay timer for system restart of all screen equipment following a power outage.

4. Main control panel shall be suitable for indoor, wall-mounting. Enclosure shall be NEMA 12 Painted Steel with continuous hinge and lockable door latch, and shall include the following:

   a. Door-interlocked and fused disconnect
   b. 600 VAC terminal block
   c. VFD and Circuit Breaker Branch Circuit Protection for screen motor
   d. Control power transformer with 120 VAC transient voltage surge compressor (TVSC) and fused primary and secondary
   e. Programmable logic controller (PLC), Allen Bradley Micrologix 1400
   f. Operator Interface (OIU), Allen Bradley PanelView 800
   g. Pilot lights for
      1. Control power on (white)
      2. Screen running (green)
      3. Screen high level (amber)
      4. Screen fault (red)
   h. E-stop push button (red)
   i. Screen reset push button (black)
   j. Door mounted elapsed time meters for the following:
      1. Screen drive
   k. Digital inputs for the following:
      1. Machine start water level
      2. Maximum water level
      3. One spare input

l. Remote dry contact outputs for the following:
   1. Screen running
   2. Screen fault
   3. Screen E-stop
   4. Screen high level
   5. One spare output

m. Flashing alarm light and alarm horn with silencer-reset button

n. All required intrinsically safe barriers and wiring methods for field devices

o. Plastic Nameplates

5. A local operator station shall be provided, and shall be suitable for wall-mounting. Enclosure shall be NEMA 7 cast Aluminum, and shall include the following:

   a. Hand-Off-Auto selector switches for the following
      1. Screen drive
   b. Screen forward-off-reverse
      1. Screen drive
   c. Spray wash pushbuttons (push-to-test)
      1. Spray bar
      2. Screenings washing system (IRGA)
      3. Compaction zone flushing
   d. E-stop pushbutton (red)

2.04 SPECIALTY TOOLS, SPARE PARTS AND LUBRICATION:

A. Manufacturer shall provide any specialty tools and spare parts required for maintaining the equipment as follows:

1. 1 set of basket cleaning brushes
2. 1 Solenoid valve rebuild kit
3. 4 Plastic rollers

A. Manufacturer shall provide a 5-year supply of lubrication required for maintaining all screen components.

PART 3 - EXECUTION

3.01 GENERAL:

A. The screening equipment shall be installed in strict conformance with the manufacturer's installation instructions and the plans and specifications, as submitted with Shop Drawings, Operation and Maintenance Manuals and/or any pre-installation checklists. Installation shall utilize standard torque values and be installed secure in position and neat in appearance. Installation shall include any site preparation tasks as required by the engineer or manufacturer; such as unloading, touch-up painting, etc. and any other installation tasks and materials such as all interconnecting wiring, conduit, and controls. The contractor shall furnish and install all components required for a complete installation.

B. All equipment shall be shipped and delivered fully assembled, except where partial disassembly is required in order to conform to transportation regulations or for the protection of components.

C. The Contractor shall be responsible for unloading of the machinery and shall have equipment on-site available at the time of delivery permitting proper hoisting of the equipment.

D. Contractor shall supply paint for field touch-up and field painting.

E. Contractor shall coat all stainless steel bolts and nut threads with a non-seizing compound prior to final assembly.

F. Operating Instructions: The Contractor shall furnish, upon completion of the equipment installation and before initial operation, an electronic copy of the draft operation and maintenance manual for all equipment furnished and installed under this contract.

The Contractor shall furnish any special tools necessary for proper maintenance and adjustment of the equipment.

3.02 FIELD TESTING:

A. After completion of installation, Contractor shall provide for testing which shall be performed in strict conformance with the manufacturer's start up instructions. Testing of the screen shall demonstrate that the equipment is fully operational by picking up and depositing materials into specified containment.

B. Field certification shall include inspection of the following:
1. Verify equipment is properly aligned and anchored per the installation instruction and drawings.
2. Assure controls and instrumentation work in all modes.
3. Check equipment for proper operation of all components as well as completion of the Start-Up requirements in the installation guide.

3.03 START-UP SERVICES:

The Equipment Manufacturer shall provide the services of a field service representative to provide Installation Certification, assist in installation and complete start-up of the screening system. Manufacturer shall furnish the services of a factory-trained Service Technician for one (1) trip including three (3) days to inspect the installation, carry-out the equipment start-up procedures, and provide training to the operators in how to effectively operate and maintain the equipment. Startup shall include instruction and assisting the Contractor and the Owner's personnel in the start-up and proper operation of the equipment.

Equipment shall not be energized, or "bumped" to check the electrical connection for motor rotation without the Service Technician present.

The Service Technician shall make all necessary adjustments and settings to the controls. In particular, the Service Engineer shall verify the measurement relay setting and the initial water level setting for the screen.

The Service Technician shall inspect and verify location of anchor bolts, placement, leveling, alignment and field erection of equipment, as well as control panel operation and electrical connections.

The Service Technician shall provide classroom and/or field training on the operation and maintenance of the equipment to operator personnel. These instructions may include the use of slides, videos, literature, and/or oral presentations.

The Service Technician shall demonstrate proper operation of screen. The screen shall operate automatically based on the water level.

The Service Technician shall make additional trips to the site at no additional cost to the Owner if the initial equipment startup does not result in fully satisfactory operation.

3.04 GUARANTEE:

The equipment manufacturer shall guarantee the equipment against defect in design, material and workmanship for a period of eighteen (18) months after date of shipment or twelve (12) months after initial operation of the equipment, whichever occurs later. This shall include all parts, labor, and freight to correct any deficiencies.

A. Manufacturer shall provide a written one-year standard warranty from the date of use of the screen equipment to guarantee that there shall be no defects in material or workmanship in any item supplied.
B. Manufacturer shall warrant for the period of 5 years all rotating parts. Manufacturer warrants that these components shall be replaced if damaged or defective in the normal use of the equipment.

END OF SECTION

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SECTION 46 21 83
SEPTAGE RECEIVING EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE

Furnish, install and place into operation a standalone septage receiving screen at the inlet/splitter box.

All equipment furnished under this Section shall be of a single manufacturer and demonstrate, to the satisfaction of the Engineer, that the quality is equal to equipment made by the base bid manufacturer specifically named herein.

The Contractor shall be responsible to coordinate all details of the screen equipment with other related parts of the Work, including verification that all structures and piping are compatible. The Contractor shall be responsible for all structural and other alterations in the Work required to accommodate the equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

Base bid shall include Micro Screen 400 Receiving Station as manufactured by ScreenCo Systems, LLC, 13235 Spur Road, Genesee, ID, 83832, (208)-790-8770.

1.02 RELATED SECTIONS

The following list of related sections is provided for the convenience of the Contractor and is for reference only to support commonly referenced sections that are in-general applicable to all equipment supplied. (For complete list of sections see specification index.)

1. Section 01 33 00 Submittals

1.03 SUBMITTALS

A. Submit in accordance with the General and Supplementary Conditions and Section 01 33 00.

B. Submit detailed shop and installation drawings to the Engineer for review.

C. List of Spare Parts and Special Tools.

D. Operation and Maintenance Manuals, including As-Built drawings, shall be provided after equipment ships for inclusion in the close-out Submittal process in accordance with Section 01 33 00.

1.04 QUALIFICATION REQUIREMENTS

A. These drawings and specifications have been prepared on the basis of using equipment as listed as base bid. The proposal allows for other suppliers with an appropriate deduct or add for other equipment. All cost associated with utilizing equipment provided by other Manufacturers shall be included in the add or deduct including all building, electrical, mechanical or any other changes necessary to install the equipment. Alternate suppliers will be considered for approval in accordance with Section 01 60 00 – “Materials and Equipment”.

PART 2 - PRODUCTS

2.01 MICRO SCREEN RECEIVING STATION

Septage receiving station shall be a Micro Screen 400 Receiving Station as manufactured by ScreenCo Systems, LLC. Screen system shall have the following characteristics:

A. Operational Requirements:

Micro screen shall be capable of receiving up to 400 gallons per minute via a 4-inch diameter inlet cam connection with fan spreader. Pipe material shall be Schedule 10 Type 304 stainless steel.

B. Screen:

Screen shall consist of 1/4" stainless steel bars gapped at 3/8" spacing.

C. Body:

Body of screen system shall be fabricated from aluminum and shall include a built-in drain tray with universal bolt-on trash chute with drain bars. Unit shall be provided with a hinged and sealed cover to be closed when the unit is not being used. The body of the screen shall consist of a standalone unit with a 6-inch diameter rear cam outlet and height-adjustable support legs.

D. Debris Chute:

Receiving station shall include an aluminum debris chute attached to the outlet of the debris collection area. Chute shall be inclined up away from the station such that debris can be raked into an adjacent trash bin, wheelbarrow, or small dumpster.

E. Accessories:

Screen system shall include two (2) cleaning tools and a stainless steel custom bar rake designed for the indicated bar spacing and diameter. Manufacturer shall also provide a matching outlet cam and PVC adaptor for use in coupling the outlet cam to a discharge pipe.

F. Fabricated Overflow Outlet:

Screen system shall be custom fabricated with an open overflow pipe welded to the screen system body. Overflow shall be connected from the screen body to the outlet pipe. Overflow pipe diameter shall be 6-inch diameter Schedule 10 Type 304 stainless steel.

G. Outlet Pipe:

Outlet pipe from screen system shall be 6-inch diameter Schedule 10 Type 304 stainless steel. Outlet pipe shall slope 2% towards the inlet/splitter box.

2.02 MATERIALS

A. Body of unit and support legs shall be fabricated from aluminum.

B. Bar screen and custom bar rake shall be fabricated from stainless steel.

PART 3 - EXECUTION

3.01 GENERAL

Installation shall be installed in strict conformance with the manufacturer's installation instructions, as submitted with Shop Drawings, Operation & Maintenance Manuals and/or any pre-installation checklists. Installation shall utilize standard torque values and be installed securely in position and neat in appearance. Installation shall include any site preparation tasks. Pre-installation tasks as determined by the manufacturer; such as unloading, touch-up painting, etc. All plumbing to be completed at site following all local and national plumbing regulations, by a qualified individual. The Contractor shall furnish and install all components required for a complete installation.

END OF SECTION

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SECTION 46 23 00
GRIT REMOVAL AND HANDLING EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE:

The Contractor shall furnish, install and place into operation all specified components of a grit removal system including all controls, accessories, and connections for a complete, functioning system.

The grit removal and handling equipment shall be of the "vortex" type, complete with drive unit, air bell, drive tube, paddle assembly, self-priming grit pump, cyclone separator, grit classifier, electrical control panel and necessary anchorage.

The Contractor shall be responsible to coordinate all details of the replacement equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible.

Base bid shall include equipment as manufactured by Lakeside Equipment Corporation, Bartlett, IL 60103. The base bid grit removal and handling equipment shall be a Lakeside SpiraGrit system with classifier. Acceptable alternate equipment includes equipment from HUBER Technology, or Engineer approved equal. Alternate equipment shall meet the requirements for alternate equipment as specified Section 01 61 00 Materials and Equipment, including but not limited to structural changes in the grit channel and chamber.

1.02 SUBMITTALS:

A. Submit in accordance with the General and Supplementary Conditions and Section 01 33 00 – "Submittals".

B. Submit detailed shop and installation drawings to the Engineer for review.

C. A complete set of drawings, specifications, catalog cut sheets, and detailed descriptive material. This information shall identify all technical and performance requirements stipulated on the Drawings and in the specification.

D. Detailed information shall be submitted for all items such as hardware, motors, reducers, motor controllers and instrumentation (field devices, major control panel devices, and anticipated control panel layout).

E. List showing materials of construction of all components.

F. Manufacturer's recommended spare parts.

G. Information on equipment field erection requirements including total weight of assembled components and weight of each sub assembly.

H. A maintenance schedule showing the required maintenance, frequency of maintenance, lubricants and other items required at each regular preventative maintenance period, including all buy out items.

I. Process equipment electrical requirements and schematic diagrams.

J. Complete list of deviations from the Drawings and specifications.

1.03 QUALIFICATION REQUIREMENTS:

A. These Drawings and specifications have been prepared on the basis of using equipment as listed as base bid. The proposal allows for other suppliers with an appropriate deduct or add for other equipment. For alternate grit removal equipment, other pump styles than the one specified in this section may be proposed as part of an add/deduct for alternate equipment. All cost associated with utilizing equipment provided by other Manufacturers shall be included in the add or deduct including all building, electrical, mechanical or any other changes necessary to install the equipment. Alternate suppliers will be considered for approval in accordance with Section 01 61 00 – "Materials and Equipment".

B. The Contractor shall provide data on alternate equipment manufacturer's experience. Only equipment of those Manufacturers with 5 or more years of experience who have furnished like equipment and specialties for at least five similar plants that have been in regular operation not less than two years will be considered. Evidence of experience and operational data may be required from the manufacturer to determine the suitability and efficiency of the equipment offered.

C. All equipment furnished under this Section and related sections shall be of a single manufacturer who has been regularly engaged in the design and manufacture of the equipment and demonstrates, to the satisfaction of the Engineer, that the quality is equal to equipment made by those manufacturers specifically named herein.

1.04 OPERATIONAL REQUIREMENTS:

A. System Operation Requirements: The grit vortex chamber and paddle system shall be sized to handle a peak wastewater flow of at least 4 million gallons per day (MGD). The grit pump shall be capable of delivering 250 gpm at a total dynamic head (TDH) of 35 feet. The grit pump TDH shall be confirmed by the manufacturer. The grit concentrator and grit screw conveyor shall be capable of handling 60 gpm. Controls shall provide automatic operation of all components of the grit removal and handling equipment.

PART 2 - PRODUCTS

2.01 GENERAL:

Base bid products to be provided, installed, and placed into operation as part of this section include one SpiraGrit SG-8-4.0 grit system including drive unit, air bell, drive tube, paddle assembly, self-priming grit pump, cyclone separator, grit classifier, electrical control panel and necessary anchorage to complete system as manufactured by Lakeside Equipment Corporation.

2.02 SYSTEM DESCRIPTION:

A. General Design Summary:

1.	Number of Grit Systems	1
2.	Rated Grit Chamber Hydraulic Capacity, mgd	4.0
3.	Average Design Flow, mgd	1.0
4.	Peak Design Flow, mgd	4.0
5.	Area classification for removal equipment	Class I, Division I
6.	Area classification for control panel	General Purpose

B. Grit Chamber Design Summary:

1.	Grit Chamber Inside Diameter, feet	8.0
2.	Grit Hopper Inside Diameter, feet	3.0
3.	Grit Chamber Drive Motor Size, hp	3/4 min
4.	Grit Chamber Maximum Operating Speed, rev/min	21
5.	Drive Tube Nominal Diameter, inches	10 or 10.75

C. Grit Cyclone Design Summary:

1.	Maximum Capacity, gal/min	250
2.	Inlet Diameter, inches	4
3.	Outlet Diameter, inches	6
4.	Vortex Finder, inches	4

D. Grit Classifier Design Summary:

1.	Maximum Underflow from Cyclone, gal/min	60
2.	Maximum Grit Conveying Capacity, cu ft/hr	30
3.	Grit Classifier Motor Size, hp	1.0 min
4.	Area Classification	Class I, Division I

E. Self-Priming Grit Pump Design Summary:

1.	Maximum Capacity, gal/min	250
2.	Total Dynamic Head, feet	35 (mfr. shall confirm)
3.	Discharge Diameter, inches	4
4.	Maximum Grit Pump Motor Size, hp	7.5
5.	Area Classification	Class I, Division I

2.03 SYSTEM PERFORMANCE:

A. The grit removal system shall be engineered to meet the following requirements at the peak design flow noted in these specifications:

1. Remove 95% of grit greater than 50 mesh in size.

2. Remove 85% of grit greater than 70 mesh in size.

3. Remove 65% of grit greater than 100 mesh in size.

The efficiency level relates to grit having a specific gravity of 2.65 and to the difference in grit content in the influent channel as compared to that of the effluent in the effluent channel.

B. The grit classifier shall be designed to receive underflow from the cyclone separator up to a flow rate as noted in these specifications and to convey the maximum grit capacity.

2.04 GRIT CHAMBER:

A. Drive Unit

The grit removal drive mechanism shall consist of an electrical motor, a helical reduction unit, and an enclosed final reduction unit consisting of one pinion and an integral gear/bearing. All

components are directly coupled, eliminating the use of chains and V-belts. The drive mechanism shall not be overloaded under normal operating conditions and shall be designed for heavy duty 24 hour per day service.

The external tooth gear shall be an external gear/bearing unit such as manufactured by Rotek, Inc., Kaydon, Inc., Rexnord-Stephan, or equal. The gear teeth shall be AGMA grade 6 or higher. The gear teeth shall have a core hardness of 250 to 300 BHN, and shall be induction hardened to a surface hardness of 52 to 60 Rc. The bearing raceway shall be hardened to 58 to 60 Rc, precision ground and have a minimum 20.5-inch ball path diameter. The main bearing shall be oil bath lubricated and have a minimum life of 20 years. The main bearing shall have a seal to prevent contamination of the bearing raceway.

The final reduction pinion shall be made of heat-treated alloy steel and shall be mounted on the output shaft of the reduction gearbox. The gear teeth shall have a core hardness of 300-350 BHN, and shall be induction hardened to a surface hardness of 52 to 60 Rc.

The final reduction pinion and main gear shall have a service factor of 5.0, or greater, at the operating speed as noted above.

The helical reduction unit shall drive the pinion of the final reduction unit. The helical reduction unit shall have a minimum service factor of 2.0. The helical reduction unit bearings shall have an average B10 life in excess of 100,000 hours.

The helical reduction unit shall be driven by a C-flanged, 1,800 rev/min, 3 phase, 60 Hertz, 230/460 volt, ball bearing, Class I, Division 1, continuous-duty, explosion proof motor with leads to a large conduit box for outdoor operation. Motor size shall be as noted in paragraph 2.02 B. 3. Thermosensors in the explosion-proof motor windings shall be rated T3C for cut-out at 160 degrees C.

The fabricated and machined steel final reduction unit housing shall be manufactured of A36 steel plate, or be a cast iron housing. All welds shall conform to applicable specifications of the American Welding Society (AWS). After welding, all mounting and mating surfaces shall be machined to insure proper fit and alignment of the drive pinion and mating gear.

The base plate on which the gear/bearing is mounted shall be a minimum of 1.125-inches thick. The surface on which the gear/bearing is mounted shall be flat within 0.005-inches. The steel plate to which the helical reduction unit is mounted shall be a minimum of 0.875-inches thick. Mounting plates integrated with the gear box casing are also acceptable.

The final reduction unit housing shall be designed to prevent water from entering the housing in case of flooding by means of a stainless steel air bell.

B. Drive Tube

The drive tube, which is driven by the main gear, shall have a nominal diameter as noted above. The drive tube shall be fabricated of stainless steel pipe with a minimum thickness of ¼-inches.

C. Paddle Assembly

The paddle assembly shall consist of four (4) fixed blades that are affixed to the drive tube by means of a two (2)-piece collar. The collar shall allow adjustment of the blade assembly in either an upward or downward position to ensure maximum grit removal. Each of the paddle blades shall have a fixed pitch of 45 degrees. The paddle assembly shall be of stainless steel construction.

D. Floor Plate

To minimize the possibility of organic capture, the grit collector shall have a minimum 10mm (0.4-inch) thick stainless steel floor plate in the grit chamber. The floor plate shall consist of two (2) removable sections to allow access to the grit storage hopper.

E. Inlet Baffle

A ¼-inch thick stainless steel baffle shall be furnished at the inlet channel to optimize the chamber's hydraulic conditions.

F. Grit Fluidizing System

A water supply line for the purpose of fluidizing settled grit shall be furnished at the bottom of the grit storage hopper. The water supply line shall include a 1.5-inch diameter manual stainless steel ball valve for flow adjustment and a 1.5-inch diameter solenoid valve to control the intermittent operation of the grit fluidization.

Solenoid valve shall be brass body suitable for 120 VAC operation, normally closed, and rated for up to 100 psig. The solenoid valve shall be slow close type to minimize water hammer.

2.05 GRIT PUMP:

A. The Base Bid grit pump shall be a Gorman-Rupp Company Super Series T Model T4A71S-B/F, or Engineer approved equal, self-priming pump. The pump shall be a 4-in. by 4-in. design and shall be capable of pumping a grit slurry flow rate of 250 gpm at a total dynamic head (TDH) of 35 feet. TDH shall be confirmed by the manufacturer.

B. The pump casing shall be Gray Iron No. 30 with a maximum operating pressure of 86 psig. The impeller shall be a two-vane design to handle a 3-in. maximum sphere size and shall be fabricated of G-R Hard Iron material for superior abrasion resistance. The impeller shaft shall be 4150 alloy steel. The pump shall be provided with a replaceable wear plate of hardened alloy steel for superior abrasion resistance. A removable cover plate shall be provided of Gray Iron No. 30.

C. The suction side of the pump shall be provided with a flap valve fabricated of steel reinforced neoprene.

D. The bearing housing shall be fabricated of Gray Iron No. 30. The seal plate shall be G-R Hard Iron material for superior abrasion resistance. The shaft sleeve shall be 4130 alloy steel. The radial bearing shall be an open single ball bearing design. The thrust bearing shall be an open double ball bearing design. The bearing and seal cavity shall be oil lubricated by SAE No. 30 non-detergent oil. The bearing and seal cavity shall be provided with oil level sight gauges.

E. The pump suction and discharge connections shall be 125 lb flanges fabricated of Gray Iron No. 30. Gaskets shall be Buna-N, synthetic fibers, vegetable fibers, PTFE, cork and rubber. O-rings shall be Buna-N.

F. Mounting hardware shall be standard plated steel. A brass pressure relieve valve shall be provided.

G. The pump seal shall be cartridge type, mechanical, oil-lubricated, double floating, self-aligning complete with tungsten carbide rotating and stationary faces, AISI Type 316 stainless steel seat, Viton fluorocarbon elastomers and 18-8 stainless steel cage and spring.

H. Motor size, electrical power characteristics and environment rating shall be as detailed in Section 2.02 of these specifications.

I. Power transmission from the motor to the pump shall be by means of a set of V-belts and sheaves. Belts and sheaves shall be designed with a minimum 1.5-service factor based on motor horsepower. Sheaves shall be two section units for both drive and driven sheaves and shall consist of a tapered split shaft bushing with three tapped holes to which the sheave is attached by three cap screws. Changing sheaves shall not require a wheel puller. Belts and sheaves shall be covered with a fabricated steel belt guard.

J. Pump and motor shall be provided on a fabricated steel base with an adjustable motor base for belt tension.

2.06 GRIT CONCENTRATOR CYCLONE:

A. The grit concentrator cyclone shall consist of a heavy-duty fabricated steel volute feed chamber with cylindrical and conical sections of steel and aluminum to minimize overhung weight. Each section of the cyclone shall be completely lined and protected from the high velocity grit by a replaceable liner. The cyclone shall be so constructed so any section liner can be replaced independently. The inlet and overflow connections shall be of 150 lb. ANSI FF steel flanges.

B. The cyclone vortex finder shall be made of an abrasion-resistant alloy with an approximate hardness of 500 Brinell. A hinge and quick disconnect clamp shall be provided between the apex assembly and lower cone section to allow removal of material which may clog the apex, without disconnecting any piping on the cyclone itself. Each cyclone inlet shall be tapped for a 1.25 inch NPT gauge connection and a diaphragm-protected pressure gauge shall be provided.

C. The cyclone underflow shall feed into the classifier for washing and dewatering, and shall be sized so that the proper hydraulic loading is provided to the classifier.

D. The cyclone overflow shall feed to piping furnished by the Contractor, which must be adequately vented to prevent siphoning.

2.07 GRIT CLASSIFIER:

A. The grit classifier shall be designed to handle an underflow from the grit cyclone as noted in these specifications. The grit classifier shall comprise a complete stainless steel assembly including drive, helicoid screw conveyor, fabricated trough with supports and necessary anchorage parts.

B. Grit from the grit cyclone shall be discharged into the dewatering section of the trough and removed by the helical screw conveyor oriented at the angle of 16 or 35 degrees. The grit screw conveyor shall be capable of handling a maximum quantity of grit as specified herein. The screw conveyor shall be 9.56-inch minimum diameter fabricated with stainless steel flights welded to a rotating 3-inch diameter Schedule 40S stainless steel pipe torque tube. The sectional flights shall be a ½ pitch or 5.9 to 7.8-inch pitch design fabricated of 5mm (0.2-inch) minimum thickness with either a field renewable ½-inch wide Lincore 60G hardened continuous weld on leading edge of the screw flights or shall be provided with field replaceable Ni-hard wear shoes. The drive end of the conveyor screw shall consist of 3-inch minimum diameter stainless steel stub shaft that is shrink-fit and attached to the upper end of the screw conveyor torque tube. The lower end of the screw shall have a 3-inch minimum diameter stainless steel shaft shrink-fit and attached to the lower end of the screw conveyor torque tube. The lower end of the grit dewatering screw shall be supported with a sealed, self-lubricated polymeric composite sleeve bearing with a stainless steel wear sleeve, or a chilled cast iron stub bearing with a maintenance-free ceramic sleeve. The removable bearing housing shall be mounted to the outside of the classifier tank via a bolted connection for ease of field replacement.

C. The grit conveyor screw shall operate in a washing-classifying trough fabricated with ¼-inch stainless steel minimum plate, fitted with a grit inlet and discharge connection. Cyclone inlet housing to the classifier shall be fabricated of 12 gauge or 2.5mm thick stainless steel sheet. The

grit discharge chute shall be fabricated of Schedule 10S stainless steel pipe, or a square-flanged discharge chute. The grit classifier tank shall be provided with a 4-inch diameter plain end Schedule 40S stainless steel overflow pipe stub. A 2-inch diameter Schedule 40S stainless steel NPT half coupling with pipe plug shall be provided to drain the tank. The supports for the grit cyclone and grit classifier tank shall be fabricated of structural stainless steel sections with a ¼-inch minimum thickness. The grit classifier shall be provided with an 2.5mm minimum thick stainless steel split cover. The cover shall be provided with both a section that is bolted to the classifier tank and a hinged cover section complete with stainless steel butt hinges and stainless steel lifting handle to open up the hinged cover section. A removable inspection hatch cover bolted to the top of the grit hopper tank is also acceptable. A neoprene gasket shall be glued to the upper classifier tank lip to prevent leakage between the classifier tank and the cover.

D. Grit laden wastewater piping from the grit pump to the grit classifier and wash water return piping from the grit classifier shall be provided by the Contractor.

E. The grit classifier screw conveyor shall be driven by a direct-connected cycloidal-helical hollow-shaft high-thrust in-line speed reducer designed for a maximum output speed of 12 rev/min. The cyclo element of the speed reducer shall be designed to take a 500 percent shock load without damage. The speed reducer manufacturer shall be a member of AGMA. Parallel shaft-geared motors shall also be acceptable.

F. The speed reducer shall be bolted to the drive adaptor flange at upper end of the grit classifier tank. The reducer shall utilize a taper grip bushing to connect to the drive shaft of the screw conveyor. The use of keys and keyways will not be an acceptable connection method for this project.

G. The speed reducer shall be driven by a field replaceable NEMA C-flanged, 1,800 rev/min, ball bearing, continuous-duty, totally enclosed, fan-cooled, explosion-proof motor with leads to a large conduit box.

H. Motor size shall be as specified herein.

2.08 CHUTE:

A. Equipment manufacturer shall furnish custom stainless steel chute to convey grit to the dumpster provided by others. Chute design shall be such that grit discharge by gravity to elevation of dumpster height as shown on the Drawings. Chute shall be fully enclosed and shall have internal access for maintenance. Chute shall be provided with wall mounted support(s) as necessary. Supports shall be mounted with clearance above finish floor elevation as shown on the Drawings.

2.09 ELECTRICAL, CONTROLS, AND INSTRUMENTATION:

A. All controls necessary for the fully automatic operation of the grit chamber drive, grit pump, and grit classifier shall be provided. The controls shall be designed to insure sufficient protection against overload in order to prevent equipment damage.

B. The remote-mounted main control panel shall include the following items:

1. Fusible disconnect switch with door handle
2. 480/120 VAC control transformer with one (1) set of spare fuses
3. Motor starters with overload coils for the grit chamber drive, grit pump, and grit classifier
4. Allen-Bradley MicroLogix 1400 programmable logic controller (PLC) with 10/100 Base T Ethernet port to monitor equipment-mounted electrical devices and to perform necessary logic functions
5. 24-hour time clock for cycle starts
6. Adjustable timers for grit pump, grit classifier and water scouring

7. Current monitor for grit chamber drive, grit pump and grit classifier
8. Elapsed time meters
9. Power on [white lens] pilot light
10. Running [green lens] pilot lights for the grit chamber drive, grit pump, and grit classifier
11. Overload shutdown [red lens] pilot light
12. Overload shutdown reset pushbutton
13. Dry contacts for connection to an external alarm system
    a. Grit chamber drive, grit pump and grit classifier running
    b. Overload shutdown for the grit chamber drive, grit pump and grit classifier
14. Intrinsically safe relay for grit pump thermal switch
15. Phenolic nameplates
16. Terminal block
17. U.L. panel label per the application
18. Alarm horn and silencer-reset pushbutton
19. NEMA 4X stainless steel wall-mounted enclosure
20. Control panel shall include an adjustable 0 to 5 minute delay timer for system restart of all grit equipment following a power outage.

C. The local operator control station shall include the following items:

1. H-O-A selector switches for the grit pump, grit classifier and water fluidization
2. On-Off selector switch for the grit chamber drive
3. Forward-Off-Reverse selector switch for the grit classifier screw conveyor
4. Cycle start pushbutton
5. Emergency stop pushbutton
6. Phenolic nameplates
7. NEMA 4/7/9 cast aluminum explosion-proof enclosure

2.10 ANCHOR BOLTS:

A. Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. Anchor bolts, hex nuts, and washers shall be AISI Type 304 stainless steel unless noted otherwise. Anchor bolts shall be J-type embedded. Expansion type anchors will not be acceptable.

B. Anchor bolts shall be set by the Contractor. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

2.11 SHOP SURFACE PREPARATION AND PAINTING:

A. All fabricated carbon steel or cast iron components for submerged service shall be near-white blast cleaned per SSPC-SP10 and given a 2.5 to 3.5 mil dry film thickness coat of Tnemec Series 1 Omnithane Primer.

B. All fabricated carbon steel or cast iron components for non-submerged service shall be commercial blast cleaned per SSPC-SP6 and given a 2.5 to 3.5 mil dry film thickness coat of Tnemec Series 1 Omnithane Primer.

C. Electric motors, speed reducers, drive units, and other self-contained or enclosed components shall be supplied with the manufacturer's standard finish coating.

D. Apply rust preventative compound to all machined, polished, and nonferrous surfaces that are not to be painted.

E. Clean all stainless steel surfaces and provide glass bead blast and chemically treat with non-toxic Citrisurf 2210 or 2050 all external non-wetted stainless steel to a uniform finish. The vortex grit

manufacturer shall clearly identify the passivation procedure methodology and shall certify that no hazardous wastes were produced.

2.12 SOURCE QUALITY CONTROL:

A. Except where specifically indicated otherwise, all plates and structural members shall have a minimum thickness of ¼-inch.

B. The equipment manufacture's shop welds and welding procedures shall be in accordance with the requirements of the latest edition of ANSI/AWS D1.1 "Structural Welding Code – Steel" published by the American Welding Society.

C. Bolts, nuts and washers shall be AISI 304 stainless steel furnished in accordance with ASTM A193.

PART 3 - EXECUTION

3.01 GENERAL:

A. The grit removal and handling equipment shall be installed in strict conformance with the manufacturer's installation instructions and the Drawings and specifications. Installation shall utilize standard torque values and be installed secure in position and neat in appearance. Installation shall include any site preparation tasks as required by the engineer or manufacturer; such as unloading, touch-up painting, etc. and any other installation tasks and materials such as all interconnecting wiring, conduit, controls and anchor bolts. The Contractor shall furnish and install all components required for a complete installation.

B. Operating Instructions: The Contractor shall furnish, upon completion of the equipment installation and before initial operation, an electronic copy of the draft operation and maintenance manual for all equipment furnished and installed under this contract.

C. Lubrication and Tools: All equipment shall have facilities for lubrication conveniently located. The Contractor shall provide lubrication equipment that will be necessary for proper maintenance. The Contractor shall also provide maintenance instructions and one year's supply of recommended lubricants for each item of equipment properly labeled.

The Contractor shall furnish any special tools necessary for proper maintenance and adjustment of the equipment.

3.02 START-UP SERVICES:

The Manufacturer shall provide the services of a Factory-trained representative to assist with the initial startup, and to instruct the Owner's operating personnel in the operation and maintenance of the equipment. The Manufacturer shall provide a minimum of one (1) trip and two (2) days for start-up and training activities.

The Equipment Manufacturer shall furnish operating and maintenance instructions for the equipment to the contractor.

3.03 GUARANTEE:

The equipment manufacturer shall guarantee the equipment against defect in design, material and workmanship for a period of eighteen (18) months after date of shipment or twelve (12) months after initial successful operation of the equipment, whichever occurs later. This shall include all parts, labor, and freight to correct any deficiencies.

END OF SECTION

SECTION 46 43 21.20
FINAL CLARIFIER EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE

The work in this section shall include all labor, equipment, and materials furnished and installed as specified herein or indicated on the drawings.

Furnish, install and place into operation one (1) peripheral-feed center take-off circular clarifier mechanisms as shown on the Drawings and described in the Specifications. Base bid shall include equipment as manufactured by Lakeside Equipment Corporation, Bartlett, Illinois.

Each collector shall be designed to remove activated sludge uniformly from the entire tank bottom on each revolution of the collector for return sludge flow rates of 300 to 800 gpm.

1.02 REFERENCES

A. American Institute of Steel Construction (AISC)

B. American Society of Testing and Materials (ASTM)

C. American Society of Civil Engineers (ASCE)

D. American Welding Society (AWS)

E. Steel Structures Painting Council (SSPC)

1.03 SUBMITTALS

A. Submit per the provisions of Section 01 33 00 Submittals.

B. Submit all product data, dimensional drawings, installation instructions, and material data for a complete installation.

C. These plans and specifications have been prepared on the basis of using equipment as listed as base bid. The proposal allows for other suppliers with an appropriate deduct or add for other equipment. All cost associated with utilizing equipment provided by other Manufacturers shall be included in the add or deduct including all building, electrical, mechanical or any other changes necessary to install the equipment. Alternate suppliers will be considered for approval in accordance with Section 01 60 00 – “Materials and Equipment.”

D. Prior to bidding, the Manufacturers shall furnish the Engineer complete descriptive information pertaining to the equipment offered to meet the specifications. Failure to provide this information will be grounds for rejection of equipment.

E. Submit qualifications package including:

1. List of twenty (20) U.S. installations of similar type equipment comparable to the units specified that have been in satisfactory use for a period of not less than ten (10) years.

2. The term "installation" shall mean individual projects/contracts. Multiple equipment units for a project will be considered as one (1) installation toward meeting the experience requirements. Installations shall be only those in the United States (fifty states). The installation shall include, but not be limited to, the following:

a. Name and location of installation.

b. Name of person in direct responsible charge for the equipment.

c. Address and phone number of person in direct responsible charge.

d. Month and year the equipment was placed in operation.

e. Brief description of equipment.

3. Test data from a minimum of two (2) hydraulic tracer studies from different locations on full-scale clarifiers of their manufacture with designs similar to the proposed clarifier design. These tests shall have been performed by a recognized independent testing laboratory or accredited university personnel. Test data based on other manufacturer's equipment will not be acceptable. Test data shall be certified by a Register Professional Engineer from the independent laboratory or accredited university who was in direct responsible charge of the tests. Test data shall include the following:

   a. Flows and dimensions of the test unit.

   b. Detention time in minutes.

   c. Surface overflow rates in gpd/sf.

   d. Type of dye tracer used and data showing concentrations versus time.

   e. Average (flow-through) detention times as determined by dye tests.

   f. Flow through half-area (Ta) from dye test.

   g. For the first full-scale test, the minimum acceptable value of Ta divided by T (theoretical detention time) shall be 0.67 at a minimum surface overflow rate of 1,000 gal/sq ft/day.

   h. The second full-scale test shall have been conducted at a surface overflow rate not to exceed 380 gal/sq ft/day.

4. A certificate proving that the fabrication facility successfully meets the quality certification requirements of the AISC Quality Certification Program as described in Section 2.12.C.

1.04 QUALITY ASSURANCE

A. It is the intent of these Specifications that all equipment called for under this Section shall be supplied by a single manufacturer. The equipment manufacturer shall, in addition to the Contractor, assume the responsibility for proper installation and functioning of the equipment.

B. The Contract Documents represent the minimum acceptable standards for the clarifier for this project. All equipment shall conform fully in every respect to the requirement of the respective parts and sections of the drawings and specifications. Equipment which is a "standard product" with that manufacturer shall be modified, redesigned from the standard mode and shall be furnished with special features, accessories, materials of construction or finishes as may be necessary to conform to the quality mandated by the technical and performance requirements of the specification.

1.05 OPERATIONAL REQUIREMENTS

A. Each clarifier mechanism shall consist of a drive assembly, a sludge removal system with scraper arms, sludge removal pipes and collection well, skirt assembly, hinged race skimmer, scum pipe assembly, inlet trough, effluent weir trough, and access bridge.

B. Design Summary:

1.	Number of clarifier mechanisms	1
2.	Diameter, feet	50
3.	Sidewater depth, feet	12.5
4.	Hydraulic loading	
	a. Minimum flow, mgd	0.5
	b. Average flow, mgd	1.0
	c. Maximum flow, mgd	2.0
5.	Minimum drive design torque, ft-lb	4,345
6.	Motor size, hp	0.5
7.	Minimum spur gear diameter, inches	36.25
8.	Maximum mechanism tip speed, ft/min	13.1
9.	Floor slope, inch/foot	0.25
10.	Number of race skimmers	1
11.	Minimum length of V-notch weir, feet	146
12.	Minimum effluent pipe diameter, inches	16
13.	Minimum scum pipe diameter, inches	10
14.	Sludge Withdrawal Rates	
	a. Minimum flow, gal/min	100
	b. Average flow, gal/min	350
	c. Maximum flow, gal/min	700

PART 2 - PRODUCTS

2.01 MATERIALS

Materials and accessories shall conform to the following specifications.

2.02 DRIVE ASSEMBLY

A. The drive assembly shall be supported by the bridge structural members and stationary column. The drive shall consist of a drive motor direct connected to a worm gear reducer, pinion gear, spur gear, shear pin hub assembly, and torque overload system.

B. The drive assembly shall be rated to operate at a minimum continuous design torque as noted in paragraph 1.03.B.5., moderate shock load, for 24 hours a day.

C. The drive motor shall be a constant speed, TEFC, "C" face, ball bearing unit of ample power for starting and operating the mechanism under normal operating conditions without overloading. The motor shall be suitable for operation at 230/460 volts (nominal), 60 Hz, 3 phase. The nominal motor rating of the circular clarifier mechanism motor shall be as noted in paragraph 1.03.B.6. The drive motor shall be directly connected to the primary speed reducer.

D. The primary speed reduction unit shall be a worm gear, heavy duty speed reducer enclosed in a cast iron housing. The reducer shall be sized for continuous duty. Bearings shall be oil or grease lubricated anti friction type. Double lip seals shall be furnished for all vertical shaft openings.

E. The drive train shall be complete with a pinion gear and spur gear. The pinion gear shall be mounted on the reducer output shaft above a self aligning flanged bearing for positive, smooth gear mesh. The spur gear shall be of the minimum diameter as noted in paragraph 1.03.B.7. and shall drive the sludge collector. The spur gear shall be supported by a roller thrust bearing mounted on the stationary column. Gears shall be protected by locating them between the bridge beams and under the bridge deck plate.

F. Gearing mounted above bridge beams will not be acceptable, and drive assemblies incorporating a drive chain or belt drive in the drive assembly will not be acceptable. Direct connection of the gear reducer to the scraper drive shaft without intermediate spur and pinion gearing will not be acceptable. Turntable or other support bearings requiring bridge disassembly for replacement of normal wear item such as strip liners will not be acceptable.

G. Each drive shall be furnished with mechanical overload protection by a shear pin assembly.

H. The shear pin assembly shall include a trip bar and limit switch arrangement. When a minimum of 150 percent of the design torque is reached, causing the shear pin to break, the limit switch shall activate the overload alarm and shutoff circuits. The switch shall be 5 amps at 120 VAC, single pole, double throw (SPDT).

2.03 SLUDGE REMOVAL SYSTEM

A. The sludge removal system shall include sludge scraper arms with integral sludge removal pipes to collect settled sludge from the clarifier tank floor and transport it to the sludge collection well. The sludge removal system shall be designed to handle the removal rates as noted in paragraph 1.03.B.14.

B. The sludge scrapers shall be connected to a cylindrical, rigid, rotating column supported from a centrally located stationary column, not less than 12 inches in diameter, by a heavy duty roller thrust bearing and steadied at the bottom by three adjustable water lubricated bearing blocks.

C. The sludge collector trusses shall be fabricated from structural steel constructed in a box form and attached to the rotating support structure by adjustable bolts at the bottom chord and field welded at the upper chord so as to permit adjustment of the entire truss arm.

D. Each sludge scraper arm shall be equipped with V shaped plow blades set to the slope of the tank floor. The blades shall be placed at intervals to assure that the entire tank floor is scraped at least twice in each revolution of the mechanism. Each plow shall be offset from its corresponding plow on the opposite scraper arm with its vertex open so that gritty material is moved to the clarifier center hopper for removal. Two squeegees, slotted for vertical adjustment, shall be fitted to each plow to move the gritty material. The center of each V plow shall locate the sludge removal nozzles which are independently connected to the sludge collection well by PVC pipes. The squeegees shall be fabricated of stainless steel material.

E. The sludge collection well shall be fabricated from ¼-inch steel and shall contain adjustable PVC valves to control the return sludge rate from each sludge removal pipe. Sludge shall be discharged from the rotating collection well through ports in the stationary clarifier center column.

F. A neoprene seal shall be provided at the collection well/center column junction to prevent leakage and sludge dilution.

G. The circular clarifier mechanism arms shall rotate in the direction shown on the drawings at a maximum tip speed as noted in paragraph 1.03.B.8.

H. Floor slope shall be as noted in paragraph 1.03.B.9.

2.04 SKIRT (BAFFLE)

A. A rigid thermoplastic skirt shall be used to form a raceway to provide proper hydraulic influent distribution. Skirt shall be shaped according to hydraulic design parameters with its maximum width at the influent trough tapering in the direction of flow to its minimum width near the scum pipe. The race, between the tank wall and the skirt, shall be open from the bottom of the clarifier to the water surface to prevent accumulation and to provide effective removal of floating matter. Constant width skirt designs will not be acceptable.

B. The skirt shall be fabricated of 0.100 inch thick rigid thermoplastic ABS plastic sheets supported at the top and bottom by 2 in. x 1 in. x 3/16 in. extruded aluminum channel. The lengths of the skirt support channel shall be factory rolled with varied radii to accomplish the changing race width. When required, reverse curvature of the channels will be made to make the transition from the scum pipe to the inlet trough.

C. Channels and sheets shall be factory punched and ready to be put together with stainless steel bolts, washers and nuts furnished by the manufacturer. The bottom of the skirt shall be approximately 2 ft above the floor.

D. Steel skirt support brackets, anchor bolts and hanger brackets shall be supplied for suspending the skirt from the inside of the tank wall. Gaskets shall be provided between the hanger brackets and support channel.

2.05 HINGED RACE SKIMMER

A. A hinged skimmer supported by the sludge scraper arm shall be furnished for the inlet race. The number of skimmer mechanisms shall be as noted in paragraph 1.02.B.10.

B. The skimmer shall be fitted with a pivot joint to allow the blade to pass under the influent baffle, the scum pipe and the effluent pipe and a counterweight so once past the obstacle, the skimmer blade returns to the surface.

C. The scum blade shall have a hinged joint to provide full coverage of the race width, even with the varied race width, to provide positive movement of the scum in the race from the influent to the scum pipe for removal.

2.06 SCUM PIPE

A. The manufacturer shall furnish a scum pipe assembly with a special wall casting to be embedded in the tank wall.

B. The 10 inch diameter double slotted scum pipe, with a machined flange on one end, shall be held in the casting by means of packing glands. The other end of the pipe shall be sealed and equipped with a rubber insulator to fit up against the skirt.

C. The scum pipe shall be provided with a handle of sufficient length and weight to permit the operator to turn the pipe to the right or left as the occasion may require.

2.07 INLET TROUGH

A. Each clarifier will be furnished with one 3/16 inch minimum steel curved inlet trough (deflector) to guide the flow into the race.

B. The trough shall be anchored to the wall at the inlet with anchor bolts.

2.08 EFFLUENT WEIR TROUGH

A. The 18.5-ft square effluent weir trough shall have a minimum length of V notched weir plates as noted in paragraph 1.03.B.11 to handle the flows noted in paragraph 1.03.B.4.

B. The weir plates shall be of ¼-inch fiberglass with 90º V notches, with 2 inch depth spaced 4½ inches on centers. The weir plates shall have 1½-inch long slots for vertical adjustment at the bolted connection to the effluent trough.

C. The effluent trough shall be a minimum 3/16 inch steel and suspended from the bridge assembly in the central portion of the tank by steel rods which permit adjustment so that the trough may be properly leveled. Support of the effluent trough by locating the support beams below the waterline which will impede the spiral hydraulics of the clarifier will not be acceptable for this project.

D. The weir trough bottom shall be sloped to provide complete trough drainage for washdown and maintenance.

E. The manufacturer shall furnish a standard steel effluent pipe of the diameter as noted in paragraph 1.03.B.12 between the effluent trough and the tank wall. A suitable pipe connection at the trough and support shall be provided.

2.09 ACCESS BRIDGE AND DRIVE PLATFORM

A. Each circular clarifier mechanism shall have a beam type access bridge spanning from the tank wall to the center. The access bridge shall be constructed of two (2) steel beams complete with necessary cross members.

B. A 36 inch wide walkway consisting of ¼-inch thick aluminum checker plate shall be furnished for the access bridge.

C. A center drive platform shall be provided. The drive platform deck shall consist of ¼-inch minimum checkered aluminum plate with hinged covers for observation and access to the lower drive components.

D. The walkway and drive platform shall be furnished with double rail 1½-inch nominal Schedule 40 minimum aluminum pipe and 4 inch steel toe plate. The access bridge aluminum railing posts shall have a maximum width spacing of 72 inches on center.

E. Neoprene gaskets shall be furnished for protection of dissimilar metals wherever aluminum railing or grating is in contact with ferrous metals.

F. The access bridge and drive platform shall be designed to support, in addition to the dead load, a live load of 50 lb/sq ft with a deflection not exceeding 1/360 of the span.

2.10 ANCHOR BOLTS

A. Equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. Anchor bolts, hex nuts, and washers shall be 304 stainless steel unless noted otherwise. Anchor bolts shall be L type embedded. Expansion type anchors will not be acceptable.

B. Anchor bolts shall be set by the Contractor. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non shrinking grout.

2.11 SHOP SURFACE PREPARATION AND PAINTING

A. All fabricated carbon steel or cast iron components for submerged service shall be near-white blast cleaned per SSPC-SP10 and given a 2.5 to 3.5 mil dry film thickness coat of Tnemec Series 1 Omnithane Primer.

B. All fabricated carbon steel or cast iron components for non-submerged service shall be commercial blast cleaned per SSPC-SP6 and given a 2.5 to 3.5 mil dry film thickness coat of Tnemec Series 1 Omnithane Primer.

C. Electric motors, speed reducers, and other self contained or enclosed components shall be supplied with the manufacturer's standard finish coating.

D. Apply rust preventative compound to all machined, polished, and nonferrous surfaces which are not to be painted.

2.12 SOURCE QUALITY CONTROL

A. All structural steel components shall be fabricated in the United States and shall conform to the requirements of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" published by the American Institute of Steel Construction. Except where specifically indicated otherwise, all plates and structural members shall have a minimum thickness of ¼-inch.

B. The equipment manufacturer's shop welds and welding procedures shall be in accordance with the requirements of the latest edition of ANSI/AWS D1.1 "Structural Welding Code Steel" published by the American Welding Society.

C. The fabrication facility shall successfully meet the quality certification requirements of the AISC Quality Certification Program with a Category I or higher. The AISC Quality Certification Program will confirm that the AISC certified shop has the personnel, organization, experience, procedures, knowledge, equipment, capability and commitment to produce fabricated steel or stainless steel of the required quality for the wastewater treatment equipment.

PART 3 - EXECUTION

3.01 GENERAL

The final clarifier equipment shall be installed in accordance with the Manufacturer’s instructions and these plans and specifications. All conduit and interconnecting wiring shall be supplied and installed by the Contractor.

The contractor shall furnish and install all components required for a complete installation.

3.02 FIELD PREPARATION AND PAINTING

A. Finish painting and field preparation shall be performed as specified in Section 09 96 00.

B. The Contractor shall touch up all shipping damage to the paint as soon as the equipment arrives on the job site.

C. Prior to the assembly all stainless steel bolts and nut threads shall be coated with a non seizing compound by the Contractor.

3.03 INSTALLATION

A. The manufacturer shall schedule one (1) trip to the project site for start up assistance and inspection of installed equipment for proper operation as noted in Paragraphs 3.02.B and 3.04.A.

B. After the Contractor has installed the equipment and the units are capable of being operated, the equipment manufacture shall furnish a qualified representative for a minimum of two (2) days to inspect the equipment and to supervise field testing and startup for the Contractor.

3.04 OPERATOR TRAINING

A. Provide operator training for Owner’s personnel after the system is operational. Training shall take place while manufacturer's representative is at the job site for equipment inspection.

3.05 GUARANTEE

The equipment manufacturer shall guarantee the equipment against defect in design, material and workmanship for a period of eighteen (18) months after date of shipment or twelve (12) months after initial operation of the equipment, whichever occurs later.

END OF SECTION

SECTION 46 51 13
FLOATING MECHANICAL AERATORS

PART 1 – GENERAL

1.01 SCOPE

A. Provide four (4) new aerators. Install two (2) aerators in the West Biosolids Basin and two (2) aerators in the East Biosolids Basin.

B. The existing two (2) aerators and associated piers located in the East Biosolids Basin shall be removed from the basin prior to installation of the new aerators.

C. Contractor shall provide adequate workers and materials to complete all installation activities. Aerator installation timing shall be coordinated with the BioPure Treatment Facility Staff and completed based on availability. No installation operations will be undertaken in freezing conditions.

1.02 RELATED WORK

A. Section 01 33 00 Submittals

B. Section 01 75 00 Starting and Adjusting

C. Section 26 00 00 Electrical

D. Section 40 96 35 Process Control Narrative

1.03 REFERENCES

A. Section 01 33 00 Submittals

B. Section 05 50 00 Metal Fabrication

C. Section 26 00 00 Electrical Specifications

1.04 SUBMITTALS

A. Shop drawings shall be submitted as specified herein that contain the layout of the aerator and all accessories.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage:

The Contractor shall store equipment in accordance with Supplier's Installation, Operation, and Maintenance manual instructions for the storage location and duration specified.

B. Shipping:

1. Supplier to ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.

2. Supplier to pack spare parts in suitable containers bearing labels clearly designating contents and pieces of equipment for which intended.

3. Supplier to deliver spare parts at same time as pertaining equipment. Deliver to Owner after completion of work.

PART 2 – PRODUCTS

2.01 GENERAL

Furnish four (4) - 50 HP floating aerators. Each aerator shall consist of a motor, a direct drive impeller driven at a constant speed and an integral flotation unit including mooring system.

2.02 MANUFACTURER

The base bid aerator specified herein shall be the Model SS Endura Series Aqua-Jet as manufactured by Aqua-Aerobic Systems, or Engineer approved equal. The Endura series shall incorporate design enhancements that provide operation for three years without routine maintenance (greasing).

2.03 AERATOR DRIVE MOTOR

A. The motor shall deliver 50 horsepower and shall be wired for 460 volt, 60 cycle, 3 phase service.

B. The motor shall be premium efficient, totally enclosed, fan cooled, and generally rated for severe chemical duty, and shall have a 1.15 service factor.

C. The motor windings shall be non-hygroscopic, and insulation shall equal or exceed NEMA Class "F".

D. For float-type aerators furnish a three-conductor cable with a ground from the motor housing of adequate length to connect to the mooring post mounted power connection junction boxes to carry the motor current. Furnish stainless steel cable strain reliefs fastened to the motor housings to minimize stresses on the cables and cable connectors at the motor housing

E. A condensate drain shall be located at the lowest point in the lower end-bell housing.

F. All motor frame parting surfaces shall be deep registered and Permatex (or equal) sealed.

G. All through bolts, nuts, and screws shall be of type 18-8 stainless steel.

H. Each motor will have a raincap constructed of cast iron or non-corrosive 304 stainless steel. Painted or plated carbon steel rain caps will not be acceptable.

I. A stainless steel nameplate shall be provided with each motor and shall be securely fastened thereto. The voltage, speed, insulation class, amperage, service factor, wiring diagram, motor serial number, and the manufacturer's name and address shall be steel stamped or otherwise permanently marked. The motor shall be an Aqua-Aerobic Systems, Inc., “Centaur” model supplied by Reliance Electric, or “Endura” model supplied by Teco-Westinghouse, Nidec (formerly US Motors), or Engineer approved equal.

2.04 MOTOR SHAFT

A. Unit shall have a one-piece motor shaft continuous from the top motor bearing, through the lower bearing and down to and through the propeller. This shaft will have a minimum diameter of 2-1/2" and be manufactured from 17-4 PH stainless steel, or comparable stainless steel having a minimum yield strength of 100,000 psi.

2.05 RPM

A. Units shall operate at the lowest RPM offered in this size by the manufacturer. Units featuring one-piece shaft shall operate at a nominal maximum speed of 1,200 RPM.

2.06 MOTOR BEARING

A. Motor bearings shall be regreasable. Sealed bearings are not acceptable. Top bearing shall be shielded on the bottom side only. Bottom bearing shall be open.

B. The top and bottom motor bearings shall be of the combined radial and axial thrust type and shall be packed at the factory with a “high performance” grease.

C. The lower motor bearing inner race shall be locked to the motor shaft via a special washer and locking nut arrangement. The shaft shall be threaded just below the lower bearing and shall have a keyway cut into the motor shaft. This key shall accept a tab from the I.D. of the locking washer, and the locking nut shall have recesses to accept a tab from the O.D. of the locking washer to prevent the nut from backing off. Snap ring type bearing retainers will not be acceptable.

2.07 MOTOR SPACE HEATERS

A. For extended storage of the unit, space heating shall be utilized to prevent condensation of moisture on the windings when the motors are not running.

B. Motor space heaters shall be energized where there is a possibility that the storage ambient conditions shall reach the dew point.

C. Space heating shall be utilized at all times when the aerator motors are not operating.

D. For float-type aerators furnish a two-conductor cable with a ground from the motor housing of adequate length to connect to the mooring post mounted power connection junction boxes to carry the space heater current. Furnish stainless steel cable strain reliefs fastened to the motor housings to minimize stresses on the cables and cable connectors at the motor housing.

E. Space heater supply circuit shall be connected through a normally closed contact on the motor starter, which shall disconnect the space heater power supply while the motor is operating.

F. Submittals shall include motor wiring and connection diagrams for all provided external connections including power, over-temp contacts, space heaters, moisture sensors, etc.

2.08 DIFFUSION HEAD

A. The design of the diffusion head shall be such that the liquid spray will discharge at angle of 90° to the motor shaft, and over a 360° pattern in the horizontal plane, and shall be a stainless steel monolithic casting.

B. The diffusion head casting shall act as a base for the aerator motor, and alignment of the motor to this base shall be controlled by machined index fittings that engage the P-base of the motor. Diffusion head/motor arrangements that are dependent upon boltholes only for alignment will not be acceptable. All diffusion head hardware will be 304 stainless steel and safety wired.

C. The diffusion head casting shall act as a thrust block to deflect the high velocity, pumped volume of the aerator from the vertical to the horizontal direction. In order to minimize vibration, and to provide adequate strength, the diffusion head casting shall weigh no less than 334 lbs. The bottom

side of this casting shall have a 90°-radiused transition to effect the hydraulic change in direction with a minimum of head loss.

D. The diffusion head shall absorb all normal and shock loads encountered by the propeller and transmitted to the diffusion head via the motor shaft and lower motor end-bell. The diffusion head shall distribute these forces into the float via webs that terminate in a flange or ring that is an integral part of the diffusion head. This flange shall mate with a similar flange that is an integral part of the float/volute to spread the stresses generated by the propeller uniformly around the float so that no point loading of the float is allowed. These flanges shall be machined flat to provide proper bearing surfaces. The alignment of the diffusion head flange to the float/volute shall be by use of a 360° index pilot.

E. Specifically, diffusion head designs that employ studs and spacers, shoulder bolts or fiberglass are not allowed. Load bearing, machined flat, flange-to-flange connections will be mandatory.

F. The diffusion head shall contain an anti-deflection journal insert to limit the radial deflection of the motor shaft.

G. This anti-deflection journal insert shall be located in the lower extremity of the diffusion head, approximately one-half the distance between the motor base and the lower end of the shaft.

H. The journal insert shall be machined from Delrin or molded from moly-filled urethane and shall be a minimum of 0.060" diameter or larger through the bore than the diameter of the motor shaft.

I. Units featuring a one-piece unsupported shaft will not be acceptable.

J. There shall be a fluid deflector located on the motor shaft immediately below the anti-deflection journal, which shall cover completely the anti-deflection journal insert and the lower portion of the diffusion head.

K. This fluid deflector shall be molded from black neoprene and shall be press fit onto the motor shaft.

2.09 FLOTATION

A. Each aerator shall have 2,740 lbs. reserve buoyancy to ensure stability and to provide support flotation required during aerator servicing. Floats shall be one piece, i.e.; segmented floats are not acceptable.

B. Flotation stability will be mandatory. Under no circumstances will unstable floatation designs requiring counter balancing, ballast of liquid, solid mass or submerged major fabricated assemblies to stabilize the operation of the aerator be allowed. Only aerators demonstrating stable operational characteristics, without rocking or oscillating will be acceptable.

C. The float shall be fabricated of 14 gauge 304 stainless steel filled with closed cell polyurethane foam.

D. All floats shall be constructed so that the internal void can and shall be filled full of closed cell polyurethane foam having a minimum 2.0 lbs/ft^3 density and shall be completely sealed water tight.

E. All floats shall have six mooring points, spaced for 3 or 4-point mooring around the outer circumference. No mooring connections will be allowed to be attached to the upper or lower float covers. Only tension type connections perpendicular to the outer sidewall will be approved. All mooring connections shall be stainless steel.

F. The float construction shall be such that the volute will distribute the load of the entire motor, drive, diffusion head and volute static load plus, the entire dynamic load from the propeller thrust and radial forces by spreading these forces uniformly around the full 360° circumference of the float's central core. Point connected joints or point stressed connections will not be accepted.

2.10 PROPELLER

A. The propeller shall be a two-blade, left-handed, marine type precision casting of stainless steel, 19-1/2" diameter, and shall be specifically designed for the application intended. It shall be a self-cleaning type that will not accumulate fibers, rags, stringy materials, etc. The propeller will have a diameter not allowing a greater clearance with the volute of 1/4".

B. Each propeller blade shall be pitched so that the pitch angle and rake angle are within ± 2 percent of the other blade(s).

C. The propeller shall be pitched so that the drive motor is loaded between 88% and 94% of full load nameplate horsepower.

D. Units using inclined screw impellers will not be acceptable.

E. The propeller must be attached to the motor shaft with a hardened stainless steel pin and set screw. No tapered, threaded shafts with nut fasteners will be acceptable.

2.11 VOLUTE

A. The propeller shall operate in a volute made of 304 stainless steel and shall be a minimum of 20" in diameter. It shall be round and true so that propeller blade tip clearance is uniform within the volute as it rotates. The volute shall have a minimum of 3/16“ wall thickness, and a minimum of four full-length stainless steel gussets shall be welded on a 90° spacing around the circumference of the volute between the top and bottom flanges.

B. The volute shall have a large machined flange at its top extremity that completely encircles the volute, and this flange shall match a similar flange on the bottom of the diffusion head to provide for a bolted, machined flange-to-flange fit to provide uniform distribution of the dynamic loads generated by the propeller and the static weight of the motor and drive. A 360° machined index in the upper flange shall provide concentric alignment of the propeller in the volute by engaging the inside diameter of the mating flange on the diffusion head. Bolt holes alone will not be acceptable to locate the important alignment of the propeller.

C. Fiberglass volutes, or carbon steel volutes that are fiberglass, steel or stainless steel lined are not acceptable.

2.12 INTAKE CONE

A. The intake cone shall be fabricated from 0.135" 304 stainless steel having a gradually expanding opening outward to the intake end. The length and inlet diameter shall be sufficient to provide uniform inlet hydraulics so that no increase in vibration is caused due to its shape or size. The minimum acceptable length is 20" and minimum inlet diameter is 30-3/4".

B. The material used to fabricate the intake cone shall be structurally sufficient to support the weight of the entire aerator assembly when the aerator is freestanding on dry ground.

C. Fiberglass intake cones are not allowed. All aerators 20 HP and larger must provide anti-vortex crosses welded inside the cones.

2.13 ANTI-EROSION ASSEMBLY

A. The aerator shall be provided with an anti-erosion assembly in order to prevent erosion during low-water operation. Anti-erosion assembly shall be fabricated from 304 stainless steel.

2.14 BALANCING

A. The entire rotating assembly including the motor rotor, shaft, shaft accessories, and impeller shall be dynamically balanced to within 2.0 mils peak-to-peak horizontal displacement measured at the upper and lower motor bearing. Measurements shall be taken at a frequency equivalent to the motor RPM.

B. Measurements shall be taken with the motor in a vertical, shaft down position and with the entire power section mounted on resilient pads.

2.15 MOORING

A. The anchor cable shall be installed as recommended by the manufacturer so the aerator shall be permitted to rise and fall with some water level variations, but will have a minimum of lateral movement.

B. The maximum amount of anticipated water level variation is 7.5 feet.

C. Anchor cable shall be 7 x 19 construction, 304 stainless steel and 1/4" diameter; nylon coated.

D. Mooring hardware (quick links, thimbles, shackles, swages, etc.) shall be of 316 stainless steel. Galvanized hardware is not acceptable.

E. Mooring post shall be constructed of 6-inch schedule 40 galvanized or stainless steel pipe as shown on the Drawings.

2.16 ELECTRICAL SERVICE CABLE

A. Electrical service cable(s) shall be provided and shall be a continuous length (non-spliced) with conductors sized to carry the connected device load. The motor power and space heaters can be served by an individual cable for each, motor power and space heaters, or a single cable with power and control conductors to serve both motor power and space heaters.

B. Conductors shall be flexible type annealed copper stranded. Each conductor, including the ground conductor, shall be insulated. Cables containing an uninsulated ground conductor will not be acceptable.

C. The insulated conductors shall be assembled together with a non-hygroscopic filler material.

D. Outer jacket shall be high quality CPE, PVC, TPE or equal, and shall be rated at a conductor operating temperature of not less than 90°C.

E. The cable shall be rated for hard usage outdoor service and shall be resistant to oil, sunlight, ozone, grease, acids, water, abrasion and impact.

PART 3 – EXECUTION

3.01 INSTALLATION, OPERATING, AND MAINTENANCE MANUALS

A. The aerator manufacturer shall provide as required copies of a detailed manual that shall include specific instructions for receiving and handling, assembly, mooring, wiring, installation, repair and service, storage, troubleshooting, detailed exploded drawings of the unit, and a full parts list.

B. In addition, the manual shall contain complete detailed instructions on the balancing procedure to be used for rebalancing to the propeller after it has been in service for an extended period of time. These instructions shall include, a general procedural description, a detailed explanation of preparing the unit for balancing and the balancing procedure for propellers.

C. These manuals shall be submitted for review, along with other general submittal information, including detailed drawings, brochures, cut-sheets, motor data sheets, etc., as a part of the approval process.

3.02 STARTUP / PERFORMANCE / ACCEPTANCE TESTING

A. A field representative and startup/performance/acceptance testing shall be in accordance with Section 01 75 00 – Starting and Adjusting.

3.03 WARRANTY

A. The aerators shall be warranted for three years for defects in materials and workmanship.

END OF SECTION

[Intentionally left blank]

SECTION 46 51 31
FLEXIBLE MEMBRANE TUBE DIFFUSERS

PART 1 – GENERAL

1.01 SCOPE OF WORK:

A. The Contractor shall furnish and install a submersible aeration system as shown on the Drawings. Aeration system includes fine bubble aeration diffusers, diffuser ballast, floating lateral air distribution/diffuser support system, anchor posts, cable, and all required hardware.

B. Aeration system shall be manufactured by Nexom/EDI, Inc., Columbia, MO as base bid.

1.02 RELATED SECTIONS:

A. Section 31 23 00 Site Grading, Excavation, and Backfill

B. Section 33 15 00 Air Supply Piping

C. Section 40 05 13 Process Piping

D. Section 03 30 00 Cast In Place Concrete

1.03 PREQUALIFICATION REQUIREMENTS:

A. All equipment furnished under this Section shall be of a single manufacturer who has been regularly engaged in the design and manufacture of the equipment and demonstrates, to the satisfaction of the Engineer, that the quality is equal to equipment made by those manufacturers specifically named herein. The manufacturer shall have supplied aeration equipment that has been in successful operation, at similar installations, for at least five (5) years.

B. The supplier shall have experience in the design, manufacturing, supplying, and commissioning of fine bubble diffuser aeration equipment of the type specified.

C. Aeration equipment shall be of proven design and shall be referenced by at least four (4) installations in cold climate wastewater treatment lagoons of similar scope, having been in operation for not less than 2 years.

D. The equipment furnished shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.

1.04 DESIGN CRITERIA:

A. The lagoon aeration system shall generally consist of a buried main air supply header with distribution laterals. Air header piping shall be per Section 33 15 00 Air Supply Piping. Lateral piping shall be connected to the main air supply header with a flanged connection and shutoff valve. Lateral pipes shall be floating laterals anchored to shore. Diffuser connection ports shall be thermally fused onto the lateral piping. A length of feeder hose shall be connected to the connection port with stainless steel clamps. The aeration diffuser shall be connected to the opposite end of the feeder hose.

B. Diffusers shall be suspended from a floating lateral to ensure all diffusers remain at a constant depth and are un-affected by sludge accumulation.

C. The aeration system including diffusers, lateral system, and feeder lines shall ensure that the lagoons do not have to be de-watered or drained for system installation or maintenance.

D. Non-retrievable submerged aeration headers/laterals will not be accepted. PVC headers will not be accepted.

E. Design aeration system is based on the following design values:

a.	Average Wet-Weather Flow:	0.5 MGD
b.	$cBOD_5$ (design):	14,000 lb/day
c.	TSS:	8,316 lb/day
d.	Total Ammonia-N:	166 lb/day

F. Design aeration system is based on the following aeration design factors:

a.	Alpha:	0.65
b.	Beta:	0.95
c.	Theta:	1.024
d.	Site Elevation:	682ft
e.	Maximum Water Temperature:	68º F
f.	Minimum Water Temperature:	33º F

G. Aeration system shall be designed to transfer sufficient oxygen to accommodate loads from cBOD removal and internal sludge digestion. The average dissolved oxygen concentration shall not be less than 2.0 mg/l in any part of the aerated lagoons.

H. Diffusers shall have a minimum Standard Oxygen Transfer Efficiency (SOTE) of 16.9% at a diffuser submergence depth of 11.0 ft, and at a maximum diffuser flux rate of 5.3 SCFM/sq.ft of active surface area.

I. Air distribution shall be designed to match the projected oxygen demand. Minimum system requirement consists of 10 laterals and 170 diffuser assemblies.

J. Air supply requirements:

a.	Maximum Inlet Temperature:	104º F
b.	Relative Humidity:	50%
c.	Normal Pressure:	7.8 psi
d.	Maximum Pressure:	8.3 psi (intermittent)
e.	Design Airflow:	11,200 SCFM

1.05 SUBMITTALS:

A. Shop drawings shall be submitted as specified herein that contain the layout of the aeration system and all accessories.

B. Submit complete aeration design calculations and results of ASCE Standard Oxygen Transfer Efficiency (SOTE) tests conducted by an independent laboratory.

1.06 WARRANTY:

A. The aeration system Supplier shall provide written warranties for the aeration system.

B. The Supplier shall repair or replace defective parts without charge to the Owner.

C. Lateral Piping and Fittings Warranty:

a. Lateral piping and fittings shall be warrantied to be free from defects in material and workmanship for a period of 24 months from the date of start-up.
b. The cost for removal (disposal) and reinstallation of any defective parts during the warrantee period shall be the responsibility of the Owner.

D. Aeration Diffuser Warranty:
a. Aeration diffusers shall be warrantied to be free from defects in material and workmanship for a period of 24 months from the date of start-up.
b. The cost for removal (disposal) and reinstallation of any defective parts during the warrantee period shall be the responsibility of the Owner.

PART 2 - PRODUCTS

2.01 AERATION PIPING:

A. Aeration piping shall be High-Density Polyethylene (HDPE) Pipe with butt-fused joints. HDPE pipe shall be PE4710 and conform to the requirements of ASTM D3350.

B. Minimum DR requirements for HDPE piping shall be DR21 for 6" HDPE piping.

C. Flange assemblies shall consist of a polyethylene stub end manufactured to match the pipe, with ductile iron slip-on flanges (for out-of-water and buried service) or stainless-steel slip-on flanges (for in-water service).

D. Provide saddles, tees, reducers, and other fittings required for the installation shown on the Drawings.

2.02 DIFFUSERS AND FEEDER TUBING:

A. Diffuser assemblies shall be G3-8 fine bubble membrane diffusers assemblies consisting of PVC support tubes with polyurethane diffuser membranes glued to a PVC distribution manifold. Maximum dry weight of individual diffuser and ballast assemblies shall be 165 lbs.

B. Each diffuser assembly shall consist of eight (8) 91mm diameter x 610mm long membranes.

C. Polyurethane diffuser membranes shall be fully supported over entre length and shall have a design life space of not less than 5 years before replacement is required.

D. Aeration supplier shall provide precast concrete diffuser ballast weight assemblies including SS support brackets with an HDPE cover around perimeter of weight. No on-site diffuser ballast weight fabrication will be accepted.

E. The G3-8 aeration diffuser unit shall be accessible from the water surface by boat for membrane maintenance, or replacement.

F. Provide two (2) complete diffuser assemblies and eight (8) membrane assemblies as spare parts

G. Diffuser outlet connections shall be heavy walled HDPE branch saddles with socket outlet connections and shall be factory side fusion welded to the HDPE lateral pipe. As determined by the manufacturer and as dictated by site conditions, branch saddles may be factory welded to short lengths of HDPE pipe and provided as prefabricated HDPE branch saddle outlet tee assemblies. Field butt fusion welding of the tee assembly will be required within the lateral at the locations indicated during the field installation procedure. Brach saddles shall have a welded contact area on the lateral pipe of a minimum of 2.1 square inches. Mechanical saddles or outlet fittings will not be accepted.

H. Feeder tubing used as the connection between the fine bubble diffuser and lateral piping shall be flexible PVC or EPDM material reinforced with spiral polyester yarn; UV and weather resistant. Nominal inside diameter shall be 1.25", with a service temperature range of -15º F to 149º F. Feeder tubing shall be cut to length in the factory.

2.03 LATERAL ANCHORING:

A. Each end of the floating laterals shall be held in place with a stainless steel cable attached to anchor posts

C. A Self-Adjusting Tension assembly shall be located at the free end of the laterals and shall have the follow characteristics:
   a. Adjustment range: +/- 20’
   b. Tension assembly to provide a minimum constant tension force of 275 lb
   c. Equipped with a winch for initial adjustments

D. Anchor posts shall be 2.5" diameter, schedule 40 galvanized pipe. Minimum embedment of posts in concrete pier shall be 24 inches. Maximum length of a fixed post shall be 48", and minimum length of a self-adjusting tension assembly post is 72"

E. Concrete pier shall be 18" diameter x 36" deep (minimum)

2.04 MISCELLANEOUS COMPONENTS:

A. Provide all other miscellaneous process equipment accessories including winches, stainless steel cable, concrete diffuser ballasts, rope, clamps, nuts/bolts, etc. as required for a complete system.

PART 3 – EXECUTION

3.01 GENERAL

A. The General Contractor shall install all supplied components in accordance with the manufacturer’s instructions and in conformance with submitted shop drawings.

B. The installer of the aeration system shall supply all materials, tools, equipment, and services necessary to install the aeration system.

C. The site shall be kept in a neat and orderly manner throughout the duration of the system installation.

3.02 AERATION PIPING INSTALLATION:

A. The General Contractor shall supply and install all air valves, main air header piping, and fittings as necessary to complete the aeration system as shown on the plans.

B. Join HDPE pipe and fittings using the butt-fusion method in accordance with the pipe manufacturer's instructions, and under the supervision of certified fusion technologists.

C. Keep piping, during the progress of the work and on completion, free from obstructions and thoroughly clean. Remove foreign material from the pipe lines and ensure lines are free from leaks. Remove and replace any defective sections.

3.03 AERATION DIFFUSER AND LATERAL INSTALLATION:

A. The General Contractor shall provide sufficient labor and equipment to install all in-basin aeration diffuser piping and accessories within the treatment cell(s).

B. Join HDPE pipe and fittings using the butt-fusion method in accordance with the pipe manufacturer's instructions, and under the supervision of certified fusion technologists.

C. Keep piping, during the progress of the work and on completion, free from obstructions and thoroughly clean. Remove foreign material from the pipe lines and ensure lines are free from leaks. Remove and replace any defective sections.

D. Install HDPE lateral piping at flange connection locations as shown on the drawings.

E. Install diffusers and feeder tubing in accordance with supplier's instructions at locations as shown on the drawings.

F. Ensure adequate water levels in cell prior to any in-water equipment installation.

3.04 MANUFACTURERS FIELD SERVICE

A. Provide services of an experienced, competent, and authorized representative of the Manufacturer (Supplier). A minimum of one (1) trip with one (1) day shall be allowed. Manufacturers field service representative shall perform air flow rate tests under normal lagoon operational conditions and visually inspect the aeration pattern to confirm uniform aeration pattern.

B. If defects are revealed during testing, the Engineer may issue instructions for removal or correcting defective work and irregularities. If any material, in whole or in part, does not conform to the Specifications or is found to be defective then such material shall be rejected by the Engineer and replaced.

3.05 COMMISSIONING

A. Supplier shall provide start-up and commissioning for the system including on-site training of the Owner's operators. A minimum of one (1) trip with one (1) day shall be allowed.

B. Check the installation of all components and provide a written commissioning report to the Engineer upon completion of installation and commissioning.

END OF SECTION 46 51 16

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Appendix A

SRF STANDARD CONTRACT LANGUAGE

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MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

Finance Division

NON-EQUIVALENCY PROJECTS CONTRACT BOILERPLATE LANGUAGE

Instructions:
The following is the required standard contract language that must appear in bidding documents of Clean Water State Revolving Fund and Drinking Water State Revolving Fund non-equivalency projects. Determination of equivalent vs. non-equivalent projects is made on a yearly basis as indicated in the Intended Use Plan (IUP) and will be communicated by your EGLE project manager. If you are unsure whether your project is equivalent, consult with your EGLE project manager.

- **American Iron & Steel Contract Language**
- **Davis-Bacon and Related Acts/Prevailing Federal Wages**
- **Labor Standards Provisions for Federally Assisted Projects**
- **Certification Regarding Debarment, Suspension, and Other Responsibility Matters*****

***Bidders should note this section contains instructions regarding forms/information that must be completed and included with any submitted bid.

American Iron and Steel Contract Language

The Contractor acknowledges to and for the benefit of the City of Hart, MI ("Purchaser") and the Michigan Department of Environment, Great Lakes, and Energy (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or the Drinking Water State Revolving Fund and such laws contain provisions commonly known as "American Iron and Steel (AIS);" that requires all iron and steel products used in the project be produced in the United States ("AIS Requirements") including iron and steel provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the AIS Requirements, (b) all iron and steel used in the project will be and/or have been produced in the United States in a manner that complies with the AIS Requirements, unless a waiver of the requirements is approved or the State made the determination in writing that the AIS Requirements do not apply to the project, and (c) the Contractor will provide any further verified information, certification, or assurance of compliance with this paragraph, or information necessary to support a waiver of the AIS requirements, as may be requested by the Purchaser.

Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Davis-Bacon and Related Acts/Prevailing Federal Wages

P.L. 111-88 requires compliance with the Davis Bacon Act and adherence to the current U.S. Department of Labor Wage Decision. Attention is called to the fact that not less than the minimum salaries and wages as set forth in the Contract Documents (see Wage Decision included herein) must be paid on this project. The Wage Decision, including modifications, must be posted by the Contractor on the job site. The “Contracting Agency” or “Contracting Officer” for Davis-Bacon Wage Decision posters on jobsites is the loan applicant/bond issuer. A copy of the Labor Standards Provisions for Federally Assisted Projects is included and is hereby a part of this contract.

"General Decision Number: MI20230142 04/14/2023

Superseded General Decision Number: MI20220142

State: Michigan

Construction Type: Building

County: Oceana County in Michigan.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2023
1	02/03/2023

2 04/14/2023

BOIL0169-002 01/01/2021

	Rates	Fringes
BOILERMAKER	$ 35.95	34.52

BRMI0009-012 08/01/2020

	Rates	Fringes
BRICKLAYER	$ 30.24	19.59
TILE SETTER	$ 26.40	20.08

FOOTNOTE:

Paid Holiday: Fourth of July, if the worker has been employed by the contractor in any period of seven working days before said holiday within the current calendar year.

CARP0100-001 06/01/2021

	Rates	Fringes
CARPENTER (Excludes Acoustical Ceiling Installation, Drywall Hanging, Form Work, Metal Stud Installation, and Soft Floor Layer-Carpet)	$ 25.24	20.31

CARP0100-007 06/01/2021

	Rates	Fringes
CARPENTER (Acoustical Ceiling Installation, Drywall Hanging, Form Work, Metal Stud Installation)	$ 25.24	20.31

CARP1102-005 06/01/2018

	Rates	Fringes
MILLWRIGHT	$ 28.59	24.79

ELEC0275-003 06/01/2021

	Rates	Fringes
ELECTRICIAN (Excludes Low Voltage Wiring)	$ 33.06	8.94+38%

ENGI0324-028 06/01/2022

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
GROUP 1	$ 44.13	24.85
GROUP 2	$ 40.83	24.85
GROUP 3	$ 38.18	24.85
GROUP 4	$ 36.47	24.85
GROUP 5	$ 30.61	24.85

GROUP 6.....$ 28.13 24.85

Crane operator with main boom and jib 300' or longer: $1.50 per hour above the group 1 rate.
Crane operator with main boom and jib 400' or longer: $3.00 per hour above the group 1 rate.

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS
GROUP 1: Crane operator with main boom and jib 400', 300', or 220' or longer.
GROUP 2: Crane operator with main boom and jib 140' or longer; tower crane; gantry crane and whirley derrick
GROUP 3: Backhoe/Excavator; Crane; Loader; Paver; Scraper; Stiff Leg Derrick
GROUP 4: Bobcat/Skid Loader; Fork Truck (over 20' lift)
GROUP 5: Fork Truck (20' lift and under for masonry work)
GROUP 6: Oiler

IRON0025-005 06/01/2022

	Rates	Fringes
IRONWORKER (REINFORCING)	$ 31.43	34.77
IRONWORKER (STRUCTURAL)	$ 34.50	38.44

IRON0025-009 04/01/2022

	Rates	Fringes
IRONWORKER, STRUCTURAL (Metal Building Erection Only)	$ 24.59	25.43

LABO0355-018 06/01/2022

EXCLUDES OPEN CUT CONSTRUCTION

	Rates	Fringes
LABORER		
Common or General;		
Sandblaster	$ 26.20	12.95
Mason Tender - Brick/Cement/Concrete	$ 30.72	12.95
Pipelayer	$ 19.80	12.85

PAIN0845-014 06/01/2022

	Rates	Fringes
PAINTER (Brush, Roller, and Spray Only)	$ 24.45	15.64
PAINTER (Drywall Finishing/Taping Only)	$ 27.21	17.43

PLAS0016-040 04/01/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 21.15	12.78
PLASTERER	$ 21.18	12.43

PLUM0174-006 07/01/2021

	Rates	Fringes
PIPEFITTER (Excluding HVAC Pipe & System Installation)	$ 37.89	23.67
PIPEFITTER (HVAC Pipe Installation Only)	$ 37.09	22.52
PLUMBER (Excluding HVAC Pipe & System Installation)	$ 37.89	23.67

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* SFMI0669-003 04/02/2023

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers)	$ 40.48	25.22

SHEE0007-034 05/01/2014

	Rates	Fringes
SHEET METAL WORKER (Excluding HVAC Duct & System Installation)	$ 28.25	13.12
SHEET METAL WORKER (HVAC System Installation Only)	$ 28.25	13.12

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* SUMI2011-067 02/14/2011

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 19.82	7.31
FLOOR LAYER: Carpet	$ 19.59	7.57
GLAZIER	$ 16.95	4.74
LABORER: Landscape & Irrigation	$ 12.84 **	0.00
OPERATOR: Bulldozer	$ 22.34	1.22
OPERATOR: Grader/Blade	$ 24.04	6.03
OPERATOR: Roller	$ 28.02	7.07
OPERATOR: Tractor	$ 19.60	7.31
ROOFER	$ 15.73 **	7.41
SHEET METAL WORKER (HVAC Duct Installation Only)	$ 19.06	6.16
TRUCK DRIVER, Includes Dump and Tandem Truck	$ 15.65 **	3.12
TRUCK DRIVER: Flatbed Truck	$ 16.80	3.97

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($16.20) or 13658 ($12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.

Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

"General Decision Number: MI20230041 02/03/2023

Superseded General Decision Number: MI20220041

State: Michigan

Construction Type: Heavy

County: Oceana County in Michigan.

Heavy, Includes Water, Sewer Lines and Excavation (Excludes Hazardous Waste Removal; Coal, Oil, Gas, Duct and other similar Pipeline Construction)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2023

1 02/03/2023

CARP0100-008 06/01/2021

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 25.24	20.31

ELEC0275-001 06/01/2022

	Rates	Fringes
ELECTRICIAN.....	$ 34.41	9.27+28%

ENGI0325-021 09/01/2022

POWER EQUIPMENT OPERATORS: Underground Construction (Including Sewer)

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	$ 37.67	24.85
GROUP 2.....	$ 32.78	24.85
GROUP 3.....	$ 32.28	24.85
GROUP 4.....	$ 32.00	24.85

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Backhoe/ Excavator, Boring Machine, Bulldozer, Crane, Scraper, Loader, Trencher (over 8 ft. digging capacity)

GROUP 2: Trencher (8-ft digging capacity and smaller)

GROUP 3: Boom Truck (non-swinging, non- powered type boom)

GROUP 4: Broom/ Sweeper, Fork Truck, Tractor

ENGI0326-020 06/01/2022

EXCLUDES UNDERGROUND CONSTRUCTION

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1.....	$ 44.13	24.85
GROUP 2.....	$ 40.83	24.85
GROUP 3.....	$ 38.18	24.85
GROUP 4.....	$ 36.47	24.85
GROUP 5.....	$ 28.13	24.85

FOOTNOTES:

Crane operator with main boom and jib 300' or longer: $1.50 per hour above the group 1 rate.
Crane operator with main boom and jib 400' or longer: $3.00 per hour above the group 1 rate.

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Crane operator with main boom and jib 400', 300', or 220' or longer.

GROUP 2: Crane operator with main boom and jib 140' or longer, tower crane, gantry crane, whirley derrick

GROUP 3: Backhoe/Excavator; Bulldozer; Compactor; Crane; Scraper; Loader

GROUP 4: Boom truck (non-swinging)

GROUP 5: Oiler

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* IRON0025-011 06/01/2022

	Rates	Fringes
IRONWORKER (REINFORCING)	$ 31.43	34.77
IRONWORKER (STRUCTURAL)	$ 34.50	38.44

LABO0334-003 09/01/2022

SCOPE OF WORK:
OPEN CUT CONSTRUCTION: Excavation of earth and sewer, utilities, and improvements, including underground piping/conduit (including inspection, cleaning, restoration, and relining)

	Rates	Fringes
LABORER		
(4) Grade Checker	$ 22.73	12.95

PLAS0016-017 04/01/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 21.15	12.78

PLUM0174-008 07/01/2022

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 39.89	23.82

TEAM0007-010 06/01/2020

	Rates	Fringes
TRUCK DRIVER		
Lowboy/Semi-Trailer Truck	$ 28.15	.50 + a+b

FOOTNOTE:
a. $470.70 per week.
b. $68.70 daily.

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* SUMI2010-039 11/09/2010

	Rates	Fringes
CARPENTER, Excludes Form Work	$ 23.97	6.29

LABORER: Common or General.....$ 13.48 ** 5.21

LABORER: Landscape.....$ 10.89 ** 1.74

LABORER: Mason Tender - Cement/Concrete.....$ 15.97 ** 3.51

LABORER: Pipelayer.....$ 15.28 ** 3.99

OPERATOR: Bobcat/Skid Steer/Skid Loader.....$ 12.98 ** 6.12

OPERATOR: Grader/Blade.....$ 15.50 ** 3.62

OPERATOR: Roller.....$ 13.74 ** 7.93

TRUCK DRIVER: Dump Truck.....$ 14.06 ** 1.25

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($16.20) or 13658 ($12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can

be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

"General Decision Number: MI20230041 01/06/2023

Superseded General Decision Number: MI20220041

State: Michigan

Construction Type: Heavy

County: Oceana County in Michigan.

Heavy, Includes Water, Sewer Lines and Excavation (Excludes Hazardous Waste Removal; Coal, Oil, Gas, Duct and other similar Pipeline Construction)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2023

CARP0100-008 06/01/2021

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 25.24	20.31

ELEC0275-001 06/01/2022

	Rates	Fringes
ELECTRICIAN.....	$ 34.41	9.27+28%

ENGI0325-021 09/01/2022

POWER EQUIPMENT OPERATORS: Underground Construction (Including Sewer)

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	$ 37.67	24.85
GROUP 2.....	$ 32.78	24.85
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POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Backhoe/ Excavator, Boring Machine, Bulldozer, Crane, Scraper, Loader, Trencher (over 8 ft. digging capacity)

GROUP 2: Trencher (8-ft digging capacity and smaller)

GROUP 3: Boom Truck (non-swinging, non- powered type boom)

GROUP 4: Broom/ Sweeper, Fork Truck, Tractor

ENGI0326-020 06/01/2022

EXCLUDES UNDERGROUND CONSTRUCTION

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1.....	$ 44.13	24.85
GROUP 2.....	$ 40.83	24.85
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GROUP 4.....	$ 36.47	24.85
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FOOTNOTES:

Crane operator with main boom and jib 300' or longer: $1.50 per hour above the group 1 rate.
Crane operator with main boom and jib 400' or longer: $3.00 per hour above the group 1 rate.

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

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GROUP 1: Crane operator with main boom and jib 400', 300', or 220' or longer.

GROUP 2: Crane operator with main boom and jib 140' or longer, tower crane, gantry crane, whirley derrick

GROUP 3: Backhoe/Excavator; Bulldozer; Compactor; Crane; Scraper; Loader

GROUP 4: Boom truck (non-swinging)

GROUP 5: Oiler

IRON0340-004 06/19/2017

	Rates	Fringes
IRONWORKER, STRUCTURAL AND REINFORCING	$ 24.43	24.67

LABO0334-003 09/01/2022

SCOPE OF WORK:
OPEN CUT CONSTRUCTION: Excavation of earth and sewer, utilities, and improvements, including underground piping/conduit (including inspection, cleaning, restoration, and relining)

	Rates	Fringes
LABORER		
(4) Grade Checker	$ 22.73	12.95

PLAS0016-017 04/01/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 21.15	12.78

PLUM0174-008 07/01/2022

	Rates	Fringes
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TEAM0007-010 06/01/2020

	Rates	Fringes
TRUCK DRIVER		
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FOOTNOTE:
a. $470.70 per week.
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SUMI2010-039 11/09/2010

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LABORER: Mason Tender - Cement/Concrete.....$ 15.97 ** 3.51

LABORER: Pipelayer.....$ 15.28 ** 3.99

OPERATOR: Bobcat/Skid Steer/Skid Loader.....$ 12.98 ** 6.12

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TRUCK DRIVER: Dump Truck.....$ 14.06 ** 1.25

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

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WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

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* a survey underlying a wage determination
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Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

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U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

§5.5 Contract provisions and related matters.

(a) The Agency head shall cause or require the contracting officer to insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated),and which is subject to the labor standards provisions of any of the acts listed in Sec. 5.1, the following clauses (or any modifications thereof to meet the particular needs of the agency, *Provided,* That such modifications are first approved by the Department of Labor):

(1) Minimum wages. (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in Sec. 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii)(A) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination, and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers, or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-dayperiod that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii) (B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fid fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside, in a separate account, assets for the meeting of obligations under the plan or program.

(2) *Withholding.* The ***(write in name of Federal Agency or the loan or grant recipient)*** shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action

as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) *Payrolls and basic records.* (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency). The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead, the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at dol.gov/agencies/whd/government-contracts/construction/forms or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency), the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

(B) Each payroll submitted shall be accompanied by a “Statement of Compliance”, signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under Sec. 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under Sec. 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the “Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the Michigan Department of Environment, Great Lakes, and Energy or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to the contractor, sponsor, applicant, or owner, take such action as maybe necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) *Apprentices and trainees*- (i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the jobsite in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates

(expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(5) *Compliance with Copeland Act requirements.* The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) *Subcontracts*. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the (write in the name of the Federal agency) may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) *Contract termination: debarment*. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) *Compliance with Davis-Bacon and Related Act requirements.* All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) *Disputes concerning labor standards.* Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

(10) *Certification of eligibility.* (i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C.1001.

(b) Contract Work Hours and Safety Standards Act. The Agency Head shall cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Sec. 5.5(a) or 4.6 of part 4 of this title. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(c) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible there for shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The ***(write in the name of the Federal agency or the loan or grant recipient)*** shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

(5) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in Sec.5.1, the Agency Head shall cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Agency Head shall cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Michigan Department of Environment, Great Lakes, and Energy and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

Certification Regarding Debarment, Suspension, and Other Responsibility Matters

The prime contractor must provide a completed *Certification Regarding Debarment, Suspension, and Other Responsibility Matters Form* with its bid or proposal package to the owner.

The prospective participant certifies, to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in transactions under federal nonprocurement programs by any federal department or agency;

(2) Have not, within the three-year period preceding the proposal, had one or more public transactions (federal, state, or local) terminated for cause or default; and

(3) Are not presently indicted or otherwise criminally or civilly charged by a government entity (federal, state, or local) and have not, within the three-year period preceding the proposal, been convicted of or had a civil judgment rendered against it:

(a) For the commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public transaction (federal, state, or local) or a procurement contract under such a public transaction;

(b) For the violation of federal or state antitrust statutes, including those proscribing price fixing between competitors, the allocation of customers between competitors, or bid rigging; or

(c) For the commission of embezzlement, theft, forgery, bribery, falsification, or destruction of records, making false statements, or receiving stolen property.

I understand that a false statement on this certification may be grounds for the rejection of this proposal or the termination of the award. In addition, under 18 U.S.C. §1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to five years, or both.

_____

Name and Title of Authorized Representative

_____

Name of Participant Agency or Firm

_____

Signature of Authorized Representative Date

☐ I am unable to certify to the above statement. Attached is my explanation.

Appendix B

STANDARD SPECIFCIATION SECTIONS

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SECTION 2

SPECIFICATIONS FOR EXCAVATING, TRENCHING, & BACKFILLING FOR UTILITIES

2.01 DESCRIPTION OF WORK

The work shall consist of furnishing all materials, equipment, and labor for excavating, trenching, and backfilling for utilities. The work also shall include the necessary clearing, sheeting and shoring, boring and jacking, dewatering, pipe embedment, and other appurtenant work.

The work shall be performed in accordance with the specifications and drawings, the MDOT 2020 Standard Specifications for Construction and the following specifications.

2.02 CLEARING, BRUSHING & TREE REMOVAL

2.02.01 General

The Contractor shall perform all clearing, brushing, and tree removal required for the proposed construction. Where indicated on the drawings for a specific area, that area shall be completely cleared in accordance with Sections 201 and 202 of the MDOT 2020 Standard Specifications for Construction. The Contractor shall notify the Engineer 48 hours (two working days) prior to commencement of clearing, brushing and tree removal. Clearing and brushing shall be confined to the limits of the right-of-way or easements unless otherwise directed and shall be kept to a practicable minimum.

Trees marked "Remove" on the drawings shall be taken down and removed from the right-of-way in a manner that does not endanger the adjoining property or persons or traffic using the right-of-way. Unless approved otherwise by the Engineer, stumps of trees are to be removed. All stump removal, shall be considered included in the major items of work to the project.

Selective pruning of trees will be permitted to allow operation of the Contractor's equipment. Trees shall be pruned neatly, and the scars from pruning or other damage by the Contractor's equipment shall be covered with a preservative.

2.02.02 Preservation of Trees

Because of the special concern for preservation of trees, all trees six (6) inches in diameter and larger, measured at a point 4 1/2' above the ground line at the base of the tree, which are to be removed have been marked on the drawings. Where there is more than one tree that has grown from a common stump, each tree is measured as a separate tree. All other trees are to be preserved unless written permission for

removal is obtained from the Owner and/or the Engineer. Where tunneling is necessary to preserve a tree, it shall be included in the major items of work. Trees that may have to be tunneled may or may not be specified on the drawings. Where tunneling is necessary, excavation may have to be done by hand to prevent damage to the tree or to its roots. When tunneling or excavating is done close to a tree to be preserved, every effort shall be made to preserve the main roots.

2.02.03 Disposal of Debris

All trees, brush, and stumps from clearing and brushing operations shall be disposed of by the Contractor by hauling from the site, or other suitable means approved by the Engineer. Burning of debris will be allowed if approved by the Engineer and Owner. The Contractor shall obtain the necessary burning permits and shall comply with the safety regulations required.

2.02.04 Measurement & Payment

The cost of all clearing, brushing, tunneling, and protection of trees which are left standing shall be considered included in the major items of work unless specific items have been provided in the Proposal in which case the prices shall be payment in full for performing this work as specified herein. All tree preservation shall be included in the major items of work to the project. Trees will be measured at a point 4-1/2' above the ground line at the base of the tree. Where more than one tree has grown from a common stump, each tree is measured as a separate tree. Trees six (6) inches in diameter and smaller will not be considered pay items.

2.03 REMOVAL OF SURFACE IMPROVEMENTS

Surface improvements such as sidewalks, improved lawns, drives, curb and gutter, and all types of pavement shall be removed just prior to excavating or trenching operations. All improvements shall be cut at the expected trench width prior to excavating using suitable equipment which does not damage the improvement outside of the trench area.

Concrete and bituminous pavement and drives shall be cut with a pavement cutting saw. The depth of the cut shall be the full depth of the pavement. Pavement crushers or breakers of any type are prohibited unless specifically authorized by the Engineer. Pavement which is removed shall not become mixed with backfill material. Power equipment may be used for pavement removal, provided that damage is not caused to improvements which are to remain.

Removal of surface improvements shall be included in the major items of work and no specific payment will be made therefore unless specific Proposal items are provided, in which case the prices bid shall be payment in full for performing this work as specified herein.

2.04 EXISTING SOIL / SUBSURFACE CONDITIONS

Where provided, soil borings are shown on the drawings only as information for use by the Engineer in preparing the contract documents. The Contractor is solely responsible for confirming actual soil conditions and depth of the water table.

2.05 EXISTING UNDERGROUND UTILITIES & STRUCTURES

2.05.01 Location

No less than three (3) working days prior to excavating, the Contractor is to call "MISS DIG" at 1-800-482-7171 or 811. Existing utilities are shown only at their approximate locations. The Contractor shall be responsible for determining their exact elevations and location in the field. The Contractor shall notify the owners of all underground utilities before starting any work. House sewer connections, water and gas services, and other utility lines may not be indicated on the drawings. However, the Contractor shall make every effort to locate all underground utilities from information obtained from the utility owner or by prospecting in advance of trench excavation.

2.05.02 Replacement

Certain underground utilities such as sewers may require removal and subsequent replacement in lieu of supporting or bracing during the proposed construction, or the Contractor may elect this option when temporary provisions to maintain essential services have been previously approved by the Engineer.

Unless otherwise specified, any utilities removed during the proposed construction shall be replaced by the Contractor. Materials and installation shall be equal to or better than original construction in every way. Salvaged materials may be reused when they are in good condition, and a satisfactory installation can be accomplished in the judgment of the Engineer.

Replacement of existing utilities shall be considered included in the major items of work unless specific items have been provided in the Proposal, in which case the prices bid shall be payment in full for performing this work as specified herein.

2.05.03 Relocation

Should any pipe or other existing utility require raising or lowering or moving to another location because of interference with the pipe or structure being constructed under these specifications, such changes which in the opinion of the Engineer are necessary shall be made by the Contractor unless otherwise specified. Relocation of existing utilities shall be included in the major items of work unless specific items are provided in the Proposal.

2.05.04 Reconnection

Where lateral services, house connections, or other pipe lines require reconnection to the proposed utility, as is the case when an existing utility is being reconstructed, the Contractor shall make these connections as specified or as shown on the drawings. All costs for making these connections, including provisions for maintaining flows and providing temporary service during the proposed construction, shall be included in the major items of work unless specific items are provided in the Proposal.

2.05.05 Utilities to be Abandoned

When pipes, conduits, sewers, or other structures are removed from the trench leaving dead ends in the ground, such ends shall be fully plugged or sealed with brick and mortar by the Contractor. Abandoned structures such as manholes or chambers shall be entirely removed unless otherwise specified or shown on the drawings.

All materials from abandoned utilities which can be readily salvaged shall be removed from the excavation by the Contractor and stored on the site or loaded on the Owner's truck as directed by the Engineer. Owner shall have first claim to salvageable materials. The Contractor is responsible to dispose of salvageable materials not desired to be kept by the Owner.

All costs for abandoning utilities and for removing and salvaging materials, when required, shall be considered included in the major items of work unless specific items have been provided in the Proposal, in which case the prices bid shall be payment in full for performing this work as specified herein.

2.06 EXCAVATING & TRENCHING

2.06.01 General

Excavating and trenching operations shall at all times be conducted in a safe, orderly manner using methods and equipment designed and suited to the intended use by personnel experienced in the work being performed.

None of the requirements or provisions specified herein or shown on the drawings shall nullify or restrict any safety provisions required by any regulation or law governing the protection and/or safety of persons or property.

2.06.02 Width of Trench

The width of the trench shall be ample to permit the pipe to be laid and joined properly and the pipe embedment material and backfill to be placed and compacted as specified. Trenches shall be of sufficient extra width when required as will permit the convenient placing of trench supports, sheeting, and bracing.

2.06.02.01 Width of Trench for Rigid Pipe

In order to limit excessive loads on rigid pipe, the maximum width of trench for pipe 36 inches and larger in diameter shall not be more than twice the nominal diameter. For smaller sizes of pipe, the maximum width of trench shall be not more than 3 feet greater than the nominal diameter of the pipe except as otherwise specified or directed. The above limiting restrictions on trench width apply from outside bottom of pipe to outside top of pipe.

Where the width of trench within these limits exceeds the maximum limit specified, the Contractor shall install a heavier class of pipe or use other means to provide additional load-carrying capacity at no additional cost to the Owner. Any changes in class of pipe or other variation shall be approved in writing by the Engineer before the work progresses.

When the trench width above the top of the pipe is appreciably greater then that which is reasonably required by project conditions in the judgment of the Engineer, any additional cost for backfill material, surface restoration, or other items that are the result of such excess width shall be borne by the Contractor.

2.06.02.02 Width of Trench for Flexible Pipe

Unless otherwise specified or approved by the Engineer, a minimum trench width of at least two (2) feet on each side of the pipe for placement of select embedment material will be required.

2.06.03 Excavating to Grade

The trench shall be excavated to a depth required for the proper installation of the pipe and placing of the pipe embedment material as specified.

Any part of the bottom of the trench excavated below the specified subgrade shall be refilled with approved materials compacted to 95% of maximum unit weight in accordance with MDOT procedures at no additional cost to the Owner. If additional excavation is required to correct unstable foundation conditions, payment will be made as specified in Section 2.08.

2.06.04 Sheeting, Shoring, Bracing, & Shelving

2.06.04.01 General

The Contractor shall brace or slope back the sides of all excavations in accordance with current MIOSHA regulations. The Contractor shall be responsible for compliance to such regulations and for the design, installation, and maintenance of all excavation safety measures.

2.06.04.02 Measurement & Payment

Unless otherwise specified in the Proposal, the costs incurred in the installation of bracing, sheeting, shoring, and shelving shall be included in the unit price bid for the work being performed.

Payment for sheeting left in place where directed by the Engineer shall be negotiated with the Contractor in accordance with the contract provisions for extra work unless specific items have been provided in the Proposal.

2.06.05 Rock Excavation

2.06.05.01 General

Wherever the word rock is used in these specifications, it shall mean boulders, solid ledge rock, and other minerals geologically placed and of a hardness when first exposed of 3 or greater in scales of mineral hardness, which in the opinion of the Engineer requires continuous use of drilling and blasting or special power equipment for its removal.

Soft disintegrated rock which can be removed with a power-operated excavator or with hand tools and loose, shaken, or previously blasted rock and broken stone in rock fillings shall not be classified as rock, nor will it be included in measurements for payment.

2.06.05.02 Hardness

The Engineer will determine the hardness of the material or minerals in question. The following accepted hardness will be used as a guide in the field for specific situations:

Gypsum - hardness of 2
Fingernail - hardness of approximately 2-1/2
Calcite - hardness of 3
Copper Coin - hardness of approximately 3
Brass Pin - hardness of approximately 3

A mineral with a hardness of 3 will scratch a copper coin and can be scratched with a brass pin. Determinations of hardness which cannot readily be determined in the field shall be resolved by laboratory analysis of the material in question.

2.06.05.03 Blasting

Where blasting is necessary, the Contractor shall obtain the required permits and licenses at his own expense. This work shall be done with due regard to the safety of workmen, other people, and public and private property. The method of covering blasts, amounts of charges used, and the general procedure for doing this work shall

conform to the standard practice and shall meet all requirements of local ordinances and other regulations and shall be subject to the approval of the Engineer.

2.06.05.04 Clearance

Rock shall be removed to provide a clearance for all pipes, appurtenances, or structures of at least eight (8) inches below, and a minimum of eight (8) inches on each side of the pipe, appurtenance, or structure.

The specified minimum clearances are the minimum clear distance which will be permitted between any part of the pipe or appurtenances being laid and any part, point, or projection of the rock.

2.06.05.05 Measurement

Only boulders of 1 cubic yard or greater in volume that cannot be removed with power excavating equipment or rock as defined herein will be measured for payment. Measurements of rock will be made by the Engineer after rock is removed from the excavation by measuring the trench before the pipe is installed.

The cross sectional area will be measured at 25 foot intervals or closer if required to accurately measure the trench. The maximum depth which will be measured for payment shall be from the top of the rock formation to the specified subgrade for the pipe embedment material. The maximum width of trench to be considered for payment shall be as follows:

1. Below outside top of pipe, maximum width shall be the outside diameter of the pipe bell plus 12 inches but not less than 30 inches.

2. From outside top of pipe to top of rock formation, maximum width shall be computed based on a 5 on 1 slope vertically for the sides of the trench.

The volume will be computed by the Engineer using the method of average end areas based on measurements of rock actually removed subject to the maximum limits specified.

2.06.05.06 Basis of Payment

Rock excavation shall be paid for at the contract price per cubic yard, which price shall be payment in full for completing all work as specified herein including removal and disposal of the rock.

If a unit price has not been established in the Proposal, payment to the Contractor will be based on the contract provisions for extra work.

2.06.06 Dewatering

The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water including water or sewage from exposed sewers or water mains, from all excavations and trenches, or other parts of the work. Each excavation shall be kept dry during the preparation of the subgrade and continually thereafter until the structure to be built or the installation of the pipe line is completed to such extent that no damage from hydrostatic pressure, flotation, or other cause will result.

Where work is in soil containing an excessive amount of water, the Contractor shall provide, install, and maintain suitable well points or wells connected to manifolds or reliable pumping equipment, or other suitable dewatering methods, and shall so operate the dewatering system to insure proper construction of the work. If the Contractor elects to use a trench underdrain or similar dewatering system, he shall receive prior approval of the Engineer as to location and installation methods for this type of system. The Contractor shall make every effort to prevent sand, sediment, or debris from entering any existing pipe line or conduit which he may use for drainage purposes. The repair or cleaning of drainage structures made necessary by the Contractor's operations shall be performed by and at the expense of the Contractor. Arrangements for discharge of ground water into any public sewer shall be previously approved by the Engineer and Owner of the receiving sewer.

Dewatering including the use of stone or gravel for dewatering purposes when required will not be paid for separately but shall be included in the contract price for the major items of work.

The Contractor shall limit his dewatering operation to the minimum time and depth required for construction. The Contractor will be required to furnish temporary water service and/or provide potable water at the direction of the Engineer to property owners whose wells are affected by the dewatering operations.

2.07 BORING & JACKING

2.07.01 General

Where so specified on the drawings, railroad tracks, streets, or other obstructions to be crossed by utilities shall be bored and/or jacked as hereinafter specified. These specifications describe the general method of conducting the boring and jacking operations and set forth minimum conditions. The location and details of the proposed installation will be shown on the Drawings.

Unless otherwise specified, the Contractor shall be responsible for obtaining any permits required for the work under the right-of-way, or other facility to be crossed, and shall carry out the details of his work in a manner that will fully meet the requirements of the authority having jurisdiction over the facility affected. No interruption of traffic will be permitted, and the Contractor shall take all precautions to that effect.

2.07.02 Casing Method

When the casing method is specified, a casing pipe shall be jacked into place and a carrier pipe shall then be installed in the casing pipe. The casing pipe shall be jacked into place by approved methods that will provide accurate alignment and grade and that will allow the carrier pipe to be installed within the casing at the specified alignment and grade.

The carrier pipe shall be joined together to form a continuous run through the casing. It shall be supported on wooden shoes or blocks which shall be securely fastened to each end of each piece of pipe or as recommended by the pipe manufacturer. The carrier pipe shall then be drawn or shoved through the casing. Junction with pipes of other materials at each end shall be made as shown on the Drawings. After the pipe has been inspected and accepted, the annular space between the pipe and the casing shall be filled with materials approved by the Owner, such as, peastone or flowable fill. After the casing has been filled, the ends of the casing shall be sealed as shown on the Drawings or in the Specifications.

2.07.03 Jacking Pipe Method

When specified or indicated on the Drawings, the pipe to be jacked shall also be utilized as the carrier pipe. The pipe shall be jacked into place by approved methods that will provide accurate alignment and grade. Excavation shall be performed ahead of the pipe by working inside the pipe or shall be performed by boring with approved equipment suitable for the intended use.

2.07.04 Measurement & Payment

The length of pipe to be measured for payment shall be the actual length of casing or jacking pipe actually jacked or pushed into place. When additional casing is specified or authorized, but is not actually jacked in place, the cost for furnishing and placing such additional casing will be paid for separately. If a unit price has not been established in the Proposal, payment will be based on the contract provisions for extra work. No additional payment will be made where the Contractor jacks or installs additional casing not shown on the Drawings or authorized by the Engineer.

The contract price per lineal foot for furnishing and jacking the pipe, or casing, where the casing method is used shall be payment in full for completing the work as specified herein including the necessary jacking pits and connections to pipes of other materials.

The carrier pipe shall be paid at the contract price for watermain, storm sewer, sanitary sewer, or force main per unit prices shown on the proposal and shall be payment in full for furnishing and installing the carrier pipe inside the casing.

2.08 SUBGRADE

The subgrade for pipe and/or structures shall be firm, dense, and thoroughly compacted and consolidated, free from mud and muck, and sufficiently stable to remain firm and intact under the feet of the workmen.

2.08.01 Unstable Foundation

When the soil beneath the normal pipe embedment area is soft or unstable, even with adequate dewatering, or in the opinion of the Engineer cannot support the pipe or utility, further depth shall be excavated and refilled to the proposed grade with MDOT Class II granular material (for plastic pipe the material must comply with ASTM D2321) compacted in twelve (12) inch layers as specified in Section 2.09.05, or other approved means shall be employed to assure a firm foundation for the utility. The volume of unstable foundation removed and replaced with approved materials for which payment will be allowed shall be determined in cubic yards unless otherwise specified on the Drawing or in the proposal. Said volume to be computed by assuming that the cross section area of the unstable foundation takes the form of a trapezoid as shown on the Standard Detail for Unstable Soil Removal for Utility.

Payment for removal and replacement of unstable foundation will be paid under the contract provisions for extra work, unless specific Proposal items have been provided, in which case, the unit price bid shall be payment in full for performing the work as specified. If the soil in the bottom of trench is soft due to excessive amounts of ground water, and/or the Contractor's method of operation, stabilization of the trench bottom shall be at the Contractor's expense.

2.08.02 Special Foundations

Where the subgrade at the bottom of the excavation consists of soil which is unstable or yielding to such a degree that, in the opinion of the Engineer, it cannot properly support the pipe or structure, the Contractor shall construct such additional foundation or reinforcement of the subgrade as may be specified, such as timber piling, geotextiles, or other means as approved by the Engineer to provide a proper foundation.

The construction of special foundations will be paid for separately based on the contract provisions for extra work, unless specific Proposal items have been provided, in which case the unit price bid shall be payment in full for performing the work as specified.

2.09 PIPE EMBEDMENT

2.09.01 General

Pipe embedment shall include the furnishing and placing of approved materials as specified or as directed from 4 inches under the outside bottom of the pipe to 12

inches over the outside top of the pipe. Various classes of pipe embedment may be specified or shown on the Drawings or Standard details in which case the limits of the various types will also be specified.

2.09.02 Flexible Pipe Embedment

Flexible pipe is any pipe having a pipe stiffness of less than 60 psi. as defined under the requirements of ASTM Designation D2412 (this includes all plastic pipe except Composite (Truss) pipe, and may include corrugated metal pipe, ductile iron pipe, and steel pipe, depending on pipe diameter and wall thickness).

Pipe embedment for flexible pipe shall be Class B as shown in the attached standard details. For pipes less than fifteen (15) inches in diameter, bedding material meeting the requirements of Section 902.07 of the MDOT 2020 Standard Specifications for Construction for granular materials Class II, modified to 100% passing a 1" sieve shall be used. If stone is used for bedding, it shall meet the requirements of ASTM D2321 (Table 1 – Embedment Classes for Plastic Pipe) for Class 1A crushed stone. An Engineer approved geotextile filter fabric shall be placed around all areas where Class 1A crushed stone pipe embedment is used as shown on the standard details. Transition zones between crushed stone and sand embedment shall be separated by a geotextile fabric. For pipes fifteen (15) inches in diameter and larger, bedding material meeting the requirements of Section 902.07 of the MDOT 2020 Standard Specifications for Construction for granular materials Class II, modified to 100% passing a 1 sieve shall be used.

2.09.03 Class B Pipe Embedment

Unless otherwise specified or shown on the Drawings, all pipe embedment shall be Class B pipe embedment as shown on the Standard details. When the soil in the bottom of the trench at pipe subgrade meets all the requirements for Granular Material Class II as specified in the MDOT 2020 Standard Specifications for Construction, Section 902.07 and in the opinion of the Engineer will provide suitable bedding for the pipe, such soil may be utilized as bedding material and prepared to receive the pipe as specified without undercutting and subsequent replacement.

Plastic pipe embedment shall comply with ASTM D2321.

2.09.04 Special Pipe Embedment

Various types of special pipe embedment may be specified or shown on the Drawings in locations where special conditions require their use. The Contractor shall perform all the work of constructing special pipe embedment where specified.

2.09.05 Placing Pipe Embedment Material

Pipe embedment material shall be placed in the bottom of the trench and shaped by hand to provide a firm and uniform bearing for the barrel of the pipe with additional shaping to accommodate the bells on bell and spigot pipe. After each pipe has been

graded, aligned, and placed in final position on the bedding material and jointing is complete, additional embedment material shall be carefully placed and compacted under and around each side of the pipe and over the pipe until it is completely covered by 12 inches of embedment material. Said material shall be distributed along both sides of the pipe uniformly and simultaneously to prevent lateral displacement of the pipe. All granular embedment material shall be compacted to 95% of maximum unit weight in accordance with MDOT procedures.

All the work of placing pipe embedment shall be considered an integral part of installing the pipe and shall be completed immediately after the pipe is laid to the correct alignment and grade.

2.09.06 Basis of Payment

All the work of furnishing and/or placing pipe embedment material as specified shall be included in the contract items for the proposed work as follows:

2.09.06.01 Class B Pipe Embedment

When a contract item has been provided in the proposal for special backfill, payment will be made under this item as specified in Paragraph 2.10 for approved granular material obtained off the site. When no specific item for special backfill has been provided, this work shall be included in the major work items.

2.09.06.02 Special Pipe Embedment

When one or more contract items have been provided in the Proposal for special pipe embedment, payment to the Contractor will be based on the prices bid for the respective items. When no specific items have been provided in the Proposal, the cost for completing this work as specified shall be included in the major work items except for authorized extra work in which case the contract provisions for extra work shall apply.

2.10 BACKFILLING ABOVE PIPE EMBEDMENT

2.10.01 General

All backfill material shall be free from cinders, ashes, refuse, sod, organic material, boulders, or rocks larger than 3 inches in diameter, frozen material or other material which in the opinion of the Engineer is unsuitable. The soil excavated from the trenches shall be used for backfilling when it is classified as suitable by the Engineer. If all or a portion of the excavated material is classified as unsuitable for backfilling, the Contractor shall remove and dispose of the unsuitable material and shall furnish and place granular material meeting the requirements of Section 902.07 of the MDOT 2020 Standard Specifications for Construction for Granular Material Class II.

All backfilling and compaction shall be performed by the Contractor using methods and equipment approved by the Engineer.

2.10.02 Trenches Requiring Compacted Granular Backfill

Trenches and excavations in the following locations shall be backfilled with approved granular material meeting the requirements of Section 902.07 of the MDOT 2020 Standard Specifications for Construction for Granular Material Class II:

a. Improved areas, including drives, sidewalks, parking areas, around structures, etc.

b. Within the limits of the roadway (within a 1 on 1 slope beginning two (2) feet from the edge of pavement or back of curb towards the right-of-way line).

c. Within the limits of future improvements (shown on Drawings).

d. Within limits specified on Drawings.

e. All sanitary sewer lateral trenches within the limits of the right-of-way.

All backfill within these areas shall be placed in layers not exceeding twelve (12) inches thick, and shall be compacted to 95% of maximum unit weight in accordance with MDOT procedures. Tests for compaction will be made by the Engineer or other representative designated by the Engineer at no cost to the Contractor. When tests indicate a density which is less than that required, the methods or equipment being used shall be modified to obtain the density specified, and the section in question shall be recompacted until the required density is obtained. The cost of retesting shall be borne by the Contractor.

2.10.03 Trenches Not Requiring Compacted Granular Backfill

Where not otherwise specified or directed, backfilling above the pipe embedment shall be made with material which is originally excavated, which is suitable. Backfill materials shall be consolidated by mechanical equipment working longitudinally in the trench, or by other approved methods, so as to be free of large voids with any excess material mounded over the trench or removed as directed by the Engineer. The trench shall be graded to a reasonable uniformity and left in a neat condition.

2.10.04 Basis of Payment

Payment for backfilling including compaction shall be made as follows:

a. When a contract item has been provided in the Proposal for special backfill, payment will be made under this item as specified in Paragraph 2.11 for approved granular material obtained off the site.

b. When no specific item for special backfill has been provided in the Proposal, this work shall be included in the major items of work.

2.11 SPECIAL BACKFILL - MEASUREMENT AND PAYMENT

2.11.01 Measurement

When an item has been provided in the Proposal for special backfill, approved granular material obtained off the site which is required by these specifications or authorized by the Engineer shall be included in this item. Special backfill shall be measured compacted in place. The Contractor shall furnish a delivery ticket for each truck load at the time the material is delivered to the project. The delivery ticket shall be prepared at least in duplicate, one copy of which shall be furnished to the Engineer or his representative, the other copy to be retained in the Contractor's file. No payment shall be made for special backfill unless the individual truck delivery tickets are furnished in this manner. The Engineer will use the delivery tickets when calculating the compacted in place quantity.

2.11.02 Payment

The Proposal unit price per cubic yard for special backfill shall be payment in full for furnishing, placing, and compacting the special backfill and for disposing of the material excavated from the trench as directed and in accordance with the Drawings and Specifications.

Stone used specifically for dewatering procedures shall not be classified as special backfill and no specific payment will be made therefor.

2.12 DISPOSAL OF EXCESS EXCAVATION

All excavated material in excess of that needed for backfill or that material classified as unsuitable by the Engineer shall be disposed of by the Contractor. However, the Engineer reserves the right to direct the Contractor to haul all or a portion of the material not required for backfilling to an area designated by the Engineer which is not more than 1,000 feet outside the project and which is reasonably accessible. This work, when directed, shall be performed at no additional cost to the Owner.

2.13 LIMITATIONS ON OPERATIONS

The Contractor shall at all times conduct his work so that there is a minimum of inconvenience to the residents and businesses in the vicinity of this project. To this end, he shall complete his backfill and remove all debris and unsuitable backfill to a point as close to the actual pipe installation as is practical and keep the area where the pipe construction and backfill has been completed in a neat condition. Open excavations shall be protected by signs, lights, barricades, and/or fence at all times when work is not actually taking place at that excavation. The placement of excavated earth along the line of the trench shall be controlled by the public’s use of the street or right-of-way and shall always be confined to approved limits.

Not more than 300 consecutive feet of street shall be closed at one time, and vehicular traffic through any street shall not be stopped for a period longer than two weeks without the written permission of the Engineer. Not more than one cross street shall be closed to vehicular traffic at the same time except by permission of the Engineer. Contractor shall maintain access for emergency vehicles at all times.

2.14 SOIL EROSION AND SEDIMENTATION CONTROL

The Contractor shall conduct his operations in such a manner that all soil is confined within the project limits and prevented from entering storm sewers, water courses, rivers, lakes, reservoirs, or wetlands.

The Contractor shall place a filter or barrier composed of straw, stone or other approved material around all catch basins or other inlets to the storm sewer or drainage courses to prevent sedimentation in these structures. After the construction operations are completed, the Contractor shall remove these filters and clean all the sediment and debris from the catch basins, ditches or other storm sewer structures.

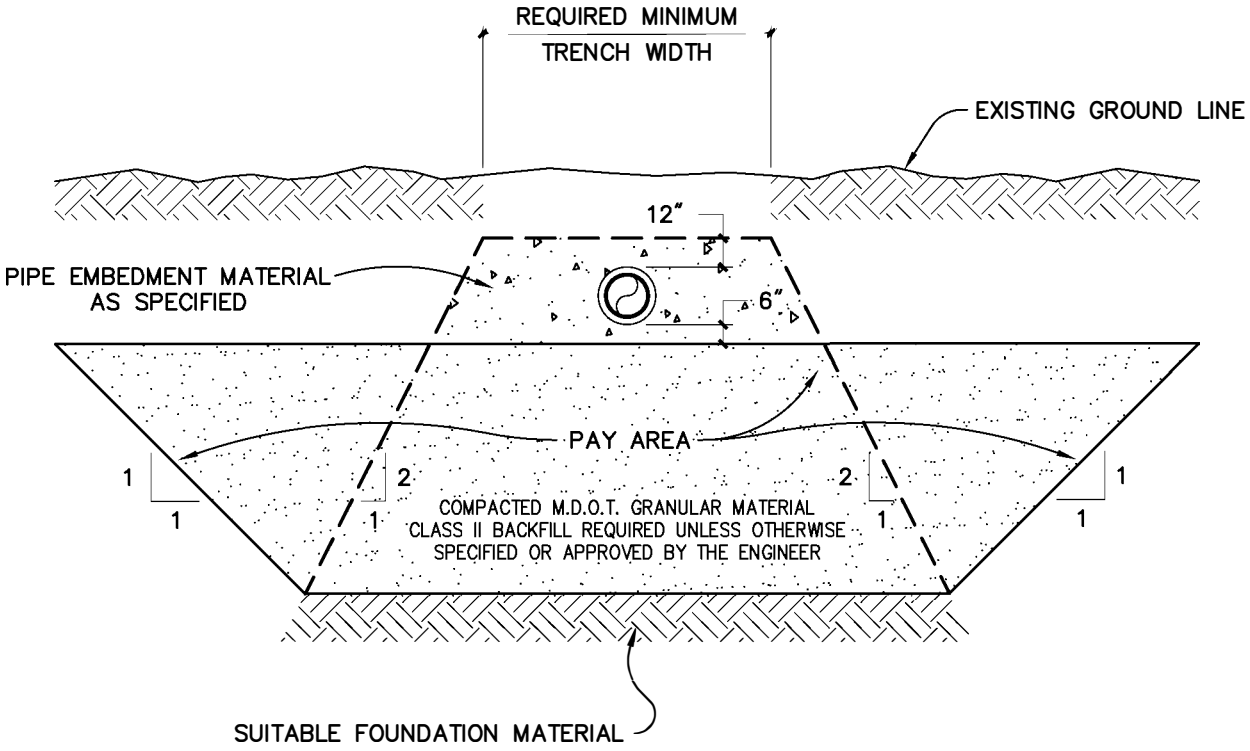
Soil erosion and sedimentation control measures if indicated on the Drawings are considered as minimum requirements and are not to be considered as complete and all-inclusive. Additional control measures as may be required due to circumstances or conditions at the time of construction or as directed by the Engineer, or the designated Soil Erosion Control agency, shall be placed as required to insure conformance with the Part 91 of PA 451 of 1994. Deviations from or additions to the erosion control measures shown on the Drawings shall be subject to the approval of the Engineer or enforcing agency.

The Contractor is responsible to have a certified storm water operator and complete all such reports as required by regulatory agencies as it relates to storm water and soil erosion and sedimentation control.

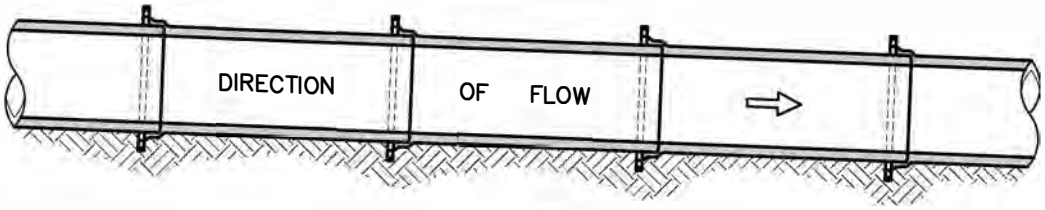
The cost of this work and other control measures which may be required or directed by the Engineer shall be included in the major work items to the cost of the project unless specific items have been provided in the proposal.

2.15 STREAM CROSSING

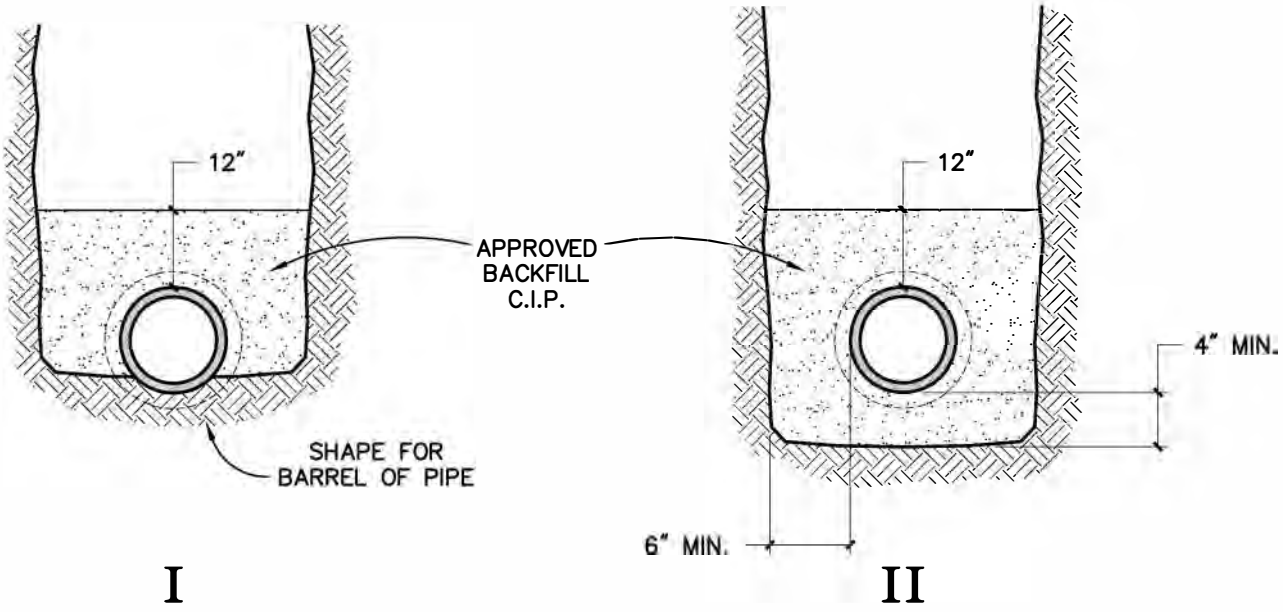
The rules and regulations of Act 451, shall govern all streams, wetland and river crossings.



UNSTABLE SOIL REMOVAL FOR UTILITY



EXCAVATION FOR BELLS



CLASS B PIPE EMBEDMENT

NOTES

1. ALL BACKFILL INDICATED SHALL BE COMPACTED TO 95% OF MAXIMUM DENSITY IN ACCORDANCE WITH M.D.O.T. PROCEDURES.
2. METHOD I SHALL BE USED IN AREAS OF UNCONSOLIDATED SOILS. (e.g. SAND, GRAVEL)
3. METHOD II SHALL BE USED IN AREAS OF CONSOLIDATED SOILS (e.g. CLAY, HARDPAN, ROCK)

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SECTION 3

SPECIFICATIONS FOR SURFACE RESTORATION

3.01 DESCRIPTION OF WORK

All areas disturbed by construction operations shall be restored to the original condition thereof as determined by the Engineer using information from drawings, surveys, and photographs or video tapes when available.

The work shall be performed in accordance with the specifications and drawings, the MDOT 2020 Standard Specifications for Construction and the following specifications.

3.02 GRADING

All streets, walks, and other improved surfaces disturbed by construction operations shall be replaced to uniform lines and grades established by the Engineer. The finish grade line will be established within three (3) inches of the existing ground profile shown on the drawings unless a proposed grade is shown which indicates otherwise.

The Contractor shall perform all grading, compacting, shaping, and related work required to prepare the subgrade to the satisfaction of the Engineer. The cost for preparing the subgrade as specified herein shall be incidental to the cost of the project, and no specific payment will be made therefor.

3.03 REPLACEMENT OF AGGREGATE STREETS AND DRIVEWAYS

Aggregate streets shall be constructed in accordance with the typical section shown on the drawings and shall consist of a minimum of six (6) inches of aggregate surface course as specified below.

3.03.01 Materials

Aggregate surface course shall meet the requirements specified in Section 306 of the MDOT 2020 Standard Specifications for Construction. All material shall be taken from stockpiles that have recently been tested by the county road commission, MDOT, or an independent laboratory.

Aggregate material that is removed from roadways and driveways shall not be reused but shall be replaced with an equivalent depth of newly compacted aggregate conforming to MDOT 22A.

3.03.02 Construction Methods

Placement of aggregate surface course shall be in accordance with the applicable portions of Section 306 of the MDOT 2020 Standard Specifications for Construction.

3.03.03 Aggregate Driveways and Field Drives

Aggregate driveways and field drives shall be replaced with a minimum of six (6) inches of MDOT 22A aggregate compacted in place.

3.03.04 Culverts

Culverts that are removed may be reused, if they are in sound condition. If damaged, the culverts shall be replaced with ASTM C76 Class III concrete pipe or equivalent pipe. The cost of removing and replacing the culverts shall be considered part of the major items of work found in the Proposal unless otherwise specified.

3.03.05 Measurement & Payment

Except as specified in Section 3.04, all replacement of aggregate streets and driveways shall be measured in lineal feet along the centerline of the main line utility being constructed and shall include all final grading and shaping required. The width of gravel replacement will not be considered for payment unless specific items to that end have been provided in the Proposal.

3.04 REPLACEMENT OF SURFACE AGGREGATE IN SPECIFIED AREAS

The Contractor shall furnish and place additional aggregate conforming to MDOT Specifications in locations determined by the Engineer for the replacement of aggregate shoulders, drives, and streets where linear measurement (as specified in Section 3.03.05) is impractical, where only part of an existing aggregate surface requires replacement, or where field conditions require replacement of the aggregate to a greater or lesser thickness than six (6) inches as determined by the Engineer.

Aggregate shoulders disturbed by the Contractor's operations shall be restored or replaced to their original width and thickness with aggregate conforming to the requirements of Section 902 of the MDOT 2020 Standard Specifications for Construction for 22A or 23A aggregate as specified.

3.04.01 Measurement & Payment

Surface aggregate shall be measured in tons or cubic yards or as specified in the Proposal. The Contractor shall furnish a truck delivery ticket for each load when it is delivered to the project which clearly states the quantity in tons or cubic yards, date of delivery, and the specific location used on the project. The price per ton or

cubic yard as bid in the Proposal shall be payment in full for furnishing, placing, compacting, and grading the surface aggregate as directed by the Engineer.

Measurement of shoulder restoration shall be in lineal feet along the centerline of the main line utility being constructed directly below the shoulder or in square yards according to the Proposal Item. If there is no Proposal Item for shoulder restoration, it shall be considered incidental to the project, and no separate payment shall be made therefor.

3.05 REPLACEMENT OF HOT MIX ASPHALT (HMA) STREETS

Hot Mix Asphalt (HMA) streets shall be constructed in accordance with the typical section shown on the drawings and, unless otherwise specified, shall meet the requirements of 13A in Section 501 of the MDOT 2020 Standard Specifications for Construction placed at 330 lbs./sq.yd. minimum (165 lbs./sq. yd. leveling, 165 lbs./sq. yd. surface) over six (6) inches of compacted 22A aggregate.

3.05.01 Materials

Aggregate base for HMA streets shall meet the requirements of 22A in Section 902 of the MDOT 2020 Standard Specifications for Construction. HMA for base, leveling, and surface courses shall be as specified, and shall conform to the requirements of Section 501 of the MDOT 2020 Standard Specifications for Construction. Materials for bond coat shall be as specified in Section 501 of the MDOT 2020 Standard Specifications for Construction.

3.05.02 Construction Methods

Aggregate base for HMA streets shall be placed in accordance with Section 302 of the MDOT 2020 Standard Specifications for Construction.

HMA mixtures shall be placed in accordance with the applicable portions of Section 501 of the MDOT 2020 Standard Specifications for Construction. For replacement of valley gutters, pavers shall be equipped with an extension to the vibrating screed adjustable to fit the typical section shown on the drawings.

The Contractor shall not place the aggregate base course until the subgrade has been approved by the Engineer. The Contractor shall not place the first HMA course and each successive HMA course until the underlying aggregate or HMA course has been approved by the Engineer.

3.05.03 Saw Cutting

HMA street, driveway and spillway replacement shall include saw cutting the asphalt pavement at the edge of the trench for the full depth of the pavement. Payment for saw cutting shall be included in the pay items for street replacement and driveway replacement unless otherwise specified.

3.05.04 Measurement & Payment

HMA street replacement shall be measured in lineal feet along the centerline of the main line utility being constructed. The width of the street replaced will not be considered for payment, and payment will not be made for any length of street replaced beyond that which is directly above the pipe installed. HMA street replacement may also be measured in square yards or tons as specified in the Proposal.

Aggregate base for HMA shall be considered part of the HMA items, and no separate payment will be made therefor unless a specific Pay Item for aggregate base is listed in the Proposal.

The cost of HMA bond coat shall be considered part of the bituminous paving.

3.06 REPLACEMENT OF AGGREGATE SURFACE OR HOT MIX ASPHALT (HMA) PAVED AREAS (PATCHING)

When the drawings and specifications do not require that the Contractor replace an entire street, the surface that is disturbed shall be replaced as specified herein.

3.06.01 Materials

Surfacing aggregate and aggregate base for HMA pavement shall conform to the requirements for 22A aggregate in Section 902 of the MDOT 2020 Standard Specifications for Construction.

Unless otherwise specified on the drawings or in the specifications, HMA 13A, conforming to the requirements in Section 501 of the MDOT 2020 Standard Specifications for Construction, shall be used for HMA patches. When existing seal coat pavement is disturbed, a HMA patch shall be placed.

3.06.02 Construction Methods

When an aggregate surface is disturbed by the Contractor's operations, the edges of the existing aggregate surface shall be trimmed and shall be free of all foreign material before the new aggregate is placed. The subgrade shall be graded and compacted to the proper lines and grades to match the adjacent surface. The aggregate shall be placed in layers not to exceed six (6) inches and shall be compacted to 98% of its maximum unit weight in accordance with MDOT procedures.

When a HMA surface is disturbed by the Contractor's operations, that surface shall be replaced at a thickness equal to the thickness of the existing pavement adjacent to the trench but not less than one and one-half (1-1/2) inches thick. If existing pavement is greater than two (2) inches in thickness, the replacement pavement shall be placed in two or more layers. Aggregate base shall be replaced at a thickness equal to the adjacent aggregate base (minimum six inches) as specified

for aggregate patches above. After placement of the aggregate base but prior to its final shaping and compaction, the edges of the existing pavement shall be trimmed to straight lines a minimum of one (1) foot from the edge of the trench to permit a straight and uniform surface between the existing and new aggregate base. Trimming of the existing pavement shall be by sawcutting or other suitable means approved by the Engineer.

All bituminous valley gutter located in disturbed HMA surface areas shall be replaced by the Contractor. Replacement of valley gutter in disturbed HMA areas shall be considered part of the HMA replacement.

3.06.03 Measurement & Payment

Replacement of aggregate surface shall be measured in lineal feet along the centerline of the main utility line being constructed. HMA paved areas (patching) shall be measured in square feet or square yards of actual aggregate surface and HMA patching replaced. Payment shall be made according to the Proposal Item for the type of surface to be replaced and shall include all trimming, removal, shaping, compacting, aggregate base, and HMA or aggregate surface.

3.07 REPLACEMENT OF CONCRETE IMPROVEMENTS

The Contractor shall replace all concrete sidewalk, drives, curb and gutter, and pavement removed during the installation of the utility or broken by the Contractor.

3.07.01 Materials

Concrete shall meet the requirements for Grade 3500 Concrete as specified in Section 1004 of the MDOT 2020 Standard Specifications for Construction. Other materials shall meet the requirements of the applicable portions of the MDOT 2020 Standard Specifications for Construction.

3.07.02 Construction Methods

The thickness of the concrete shall be the same as the concrete adjacent to the trench but shall not be less than four (4) inches. The alignment and grade and the contour and finish of the surface shall be the same as the concrete adjacent to the trench unless otherwise directed by the Engineer.

Pavements, walks, and drives shall be sawcut at the edges of the trench or removed to existing joints. The depth of the saw cut shall not be less than the full depth of the concrete.

The forms and joints and the methods of placing, curing, and protection shall be consistent with standard practice and shall meet all the requirements of the MDOT 2020 Standard Specifications for Construction for the various items.

3.07.03 Concrete Curb & Gutter (Header Curb, 18 inch, 24 inch, and 30 inch)

Concrete curb and gutter shall match the existing curb and contain two No. 4 steel reinforcing bars. Concrete shall be Grade 3500. Payment shall be made in lineal feet of curb and gutter replaced. All joints shall be saw cut. Curb and gutter shall be placed in accordance with Section 802 of the MDOT 2020 Standard Specifications for Construction.

3.07.04 Sidewalk and Concrete Driveways

Sidewalk and concrete driveways shall be placed in accordance with Section 801 & 803 of the MDOT 2020 Standard Specifications for Construction. Concrete shall be air entrained. All 6-inch thick concrete sidewalks shall include 6x6-W2.9xW2.9 woven wire steel mesh.

3.07.05 Measurement & Payment

Concrete walks, pavement, and drives will be measured in square feet or square yards of actual concrete surface replaced. Concrete curb and gutter shall be considered part of the construction of the utility line unless a specific item is provided in the Proposal for its replacement. If so specified, the concrete curb and gutter or valley gutter replacement shall be paid for in lineal feet measured along the face of a header curb or along the flow line of gutter when constructed as part of the curb. Concrete that has been broken by the Contractor outside the limits of the trench will not be considered for payment unless otherwise specified.

3.08 REPLACEMENT OF LAWN IMPROVEMENTS

3.08.01 Underground Sprinkling Equipment

Underground sprinkling lines, valves & heads, and water system curb stops and boxes are specifically excluded from the pay items. The Contractor shall take the necessary precautions to preserve this equipment during construction. Any underground sprinkling equipment disturbed by the Contractor shall be replaced at the Contractor's expense.

All underground sprinkling equipment shall be replaced in a timely fashion so as to minimize damage to the lawn areas. The Contractor will be responsible for any lawn damage caused by delayed replacement of the sprinkling equipment.

3.08.02 Fences

Fences, which are removed for construction, shall be replaced with equal or better type and size. The cost of removing and replacing the fences shall be considered part of the major items of work found in the Proposal unless otherwise specified.

3.08.03 Ornamental Shrubbery and Bushes

Ornamental shrubbery and bushes that are removed during construction shall be replaced in kind and size in a vigorous growing condition. Replacement costs shall be considered part of the major items of work found in the Proposal unless otherwise specified. All shrubs and bushes replaced shall be insured by a one-(1) year warranty commencing from the date of installation.

3.09 TURF RESTORATION

All areas of established turf shall be replaced as nearly as possible to their original condition.

3.09.01 Topsoil

Topsoil shall be placed at a minimum depth of four (4) inches over all areas disturbed by the Contractor's operations. The subgrade shall be graded to conform to the adjacent contours and shall be approved by the Engineer before placing topsoil. The topsoil shall then be placed in accordance with Section 816 of the MDOT 2020 Standard Specifications for Construction.

The soil shall be dark, organic natural surface soil, exclusive of muck or peat, suitable for the establishment of grass or other vegetable growth.

3.09.02 Fertilizer

After the topsoil has been placed, it shall be fertilized with a starter fertilizer at the rate of two (2) pounds per 1,000 square feet, in proportions of 16% nitrogen, 32% phosphoric acid, and 3% potash, or as directed by the Engineer. Fertilizer shall be applied just before the placing of the seed to retain its full benefit before unfavorable weather can cause deterioration.

3.09.03 Seeding

All previously seeded lawn areas shall be reseeded with Class A seed. Other areas disturbed by the Contractor's operations shall be seeded with Roadside seed. Temporary seed shall be placed for erosion control or temporary soil stabilization of stockpile areas. Seed mixtures, application rates, and methods shall be in accordance with Section 816 of the MDOT 2020 Standard Specifications for Construction.

Seasonal limitations on seeding in Section 816 of the MDOT 2020 Standard Specifications for Construction are waived. The Contractor shall repeat the seeding procedure as often as necessary to produce a close stand of weed-free grass.

3.09.04 Mulching

All seeded areas shall be mulched immediately following the seeding. Mulching shall be applied to all newly seeded areas at a rate of two (2) tons per acre in accordance with the requirements of Section 816 of the MDOT 2020 Standard Specifications for Construction, or as directed by the Engineer. Separate loose straw mulch is prohibited on residential lawn areas.

3.09.05 Hydro Application

All fertilizing, seeding and mulching shall be applied by an approved Hydro seeding and mulching process unless separate applications as heretofore described are approved by the Engineer.

3.09.06 Erosion Control

All erosion control measures shall be installed and maintained in accordance with the Soil Erosion and Sedimentation Control plan and permit. Unless otherwise specified, mulch blanket and high velocity blanket shall be placed in accordance with Section 816 of the MDOT 2020 Standard Specifications for Construction.

3.09.07 Sod

Sod shall be placed only where directed by the Engineer or as noted on the drawings or specifications.

All sod shall be nursery grown, conforming to MDOT requirements for Class A. Sod shall be approved by the Engineer before placing and shall be placed in accordance with the requirements of Section 816 of the MDOT 2020 Standard Specifications for Construction. The base on which the sod is to be laid shall consist of a minimum of four (4) inches of topsoil placed, watered and fertilized in the same manner required for seeding.

3.09.08 Measurement & Payment

Turf restoration will be measured in lineal feet along the centerline of the main utility line being constructed. Payment will be made according to the appropriate item for seeding or sod. Topsoil, fertilizer, mulch and erosion control shall be incidental to these items unless specific proposal items are provided. Any area disturbed by the Contractor's operations outside of the limits of the trench shall be restored by the Contractor to its original condition but will not be considered for payment.

3.10 SCHEDULING OF RESTORATION WORK

Initial restoration (rough grading, temporary aggregate if necessary, removal of excess excavated material and debris) shall be done each day to the extent necessary to allow the movement of local traffic and permit access to all properties

for emergency vehicles. Maintenance of streets, drives, sidewalks, etc. shall be the responsibility of the Contractor (including dust control, grading, stabilization, etc.) until the restoration is complete and has been accepted by the Engineer.

Restoration of each street or section of utility line shall follow the construction in a timely fashion so as to minimize inconvenience to the adjacent property owners and the general public. The manner in which this restoration is done by the Contractor will be a determining factor in the approval by the Engineer of staking requests and partial payment requests.

3.11 LIMITS FOR MEASUREMENT & PAYMENT FOR SURFACE RESTORATION

All work necessary to return the area of construction operations to its original condition, other than the items listed in the Proposal, shall be considered incidental to the construction, and no specific payment will be made therefor.

For surface restoration items measured in lineal feet, payment will be based upon the type of surface that is directly above the utility. Only one surface restoration item shall be paid for each lineal foot of utility. Additional restoration on either side of the utility to the limits of construction will be done by the Contractor at no additional cost to the Owner. For example, when the utility is directly under the bituminous street, only the item of bituminous street restoration will be paid. Topsoil, seed, fertilizer and mulch required to restore the area adjacent to the street will not be paid for separately.

Payment will be made for the proposal items only. All of the work specified above and indicated on the drawings will be considered included in the unit prices.

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SECTION 4

SPECIFICATIONS FOR WATER MAINS

4.01 DESCRIPTION OF WORK

The work shall consist of furnishing and installing water main of the specified size or sizes at the depths shown on the drawings or specified herein, and furnishing all fittings and joint material, labor, materials, tools, and equipment for receiving, unloading, transporting, laying, testing, and disinfecting of water pipe and fittings. Contractor shall furnish all hydrants, valves, valve boxes and other necessary accessories to complete the pipe work as shown on the drawings and specified herein. Excavating, trenching and backfilling shall be as specified in Section 2.

The work shall be performed in accordance with the specifications and drawings, the MDOT 2020 Standard Specifications for Construction and the following specifications.

4.02 MATERIALS

All materials furnished by the Contractor shall conform to the specifications which follow. Where reference specifications are mentioned the current edition or latest issue shall be used. All water main material shall meet NSF Standard 61.

4.02.01 Ductile Iron Pipe

4.02.01.01 Pipe

Ductile iron pipe shall conform to the requirements of AWWA C151 (ANSI A21.51) and C150 (ANSI A21.50). Ductile iron pipe shall be Class 53 unless otherwise specified.

All pipe shall have a cement mortar lining with seal coat conforming to the requirements of AWWA C104 (ANSI A21.4). Seal coat shall have NSF61 approval for use with potable water.

4.02.01.02 Fittings

All fittings shall be ductile iron in accordance with AWWA C110 (ANSI A21.10) or AWWA C153 (ANSI A21.53). Fittings twenty four (24) inch diameter and smaller shall have a minimum pressure rating of 350 psi.; fittings larger than twenty four (24) inch diameter shall have a minimum pressure rating of 250 psi. Fittings shall have either cement mortar lined with seal coat in accordance with AWWA C104 (ANSI A21.4) or fusion bonded epoxy coating in accordance with AWWA C116 (ANSI A21.16). Lining shall have NSF61 approval for use with potable water.

4.02.01.03 Joints

Unless otherwise specified, all pipe joints shall be rubber gasket joints conforming to the requirements of AWWA C111 (ANSI A21.11) for bolted mechanical joints or push-on joints. Joints on fittings shall be restrained in accordance with Section 4.12.

4.02.02 Polyvinyl Chloride (PVC) and Molecularly Oriented PVC (PVCO) Pipe

4.02.02.01 Pipe

All polyvinyl chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) pipe for use in public water supply distribution systems shall meet ANSI/NSF Standard 14 regardless of the method of installation. The pipe shall be stamped either "NSF-pw" or otherwise marked to state that the pipe has been certified to Standard 14 requirements by a certified third party.

Polyvinyl chloride (PVC) pipe, four inch through twelve inch (4" - 12") diameter, shall conform to ANSI/AWWA C900. The pipe shall have a pressure rating of 305 psi. The PVC pressure pipe shall have an outside diameter equivalent to cast iron and ductile iron pipe.

Polyvinyl chloride (PVC) pipe, fourteen inch through forty-eight inch (14" – 48") diameter shall conform to ANSI/AWWA C905. The pipe shall have a pressure rating of 305 psi. The PVC pressure pipe shall have an outside diameter equivalent to cast iron and ductile iron pipe.

Molecularly Oriented Polyvinyl Chloride (PVCO) pipe four inch through twenty-four inch (4" - 24") diameter shall conform to ANSI/AWWA C909. The pipe shall have a pressure rating of 305 psi. The PVCO pressure pipe shall have an outside diameter equivalent to cast iron and ductile iron pipe.

Pipe color shall be blue or as required by the Owner.

4.02.02.02 Fittings

Fittings shall be ductile iron as specified in Section 4.02.01.02.

Anchorage (restraint) of bends, tees, plugs and all other fittings shall be per Section 4.12.05 of this specification. Thrust blocks and tie rods will only be allowed if no other method is possible according to the Engineer. For PVC and PVCO water main, the restraint lengths specified in the table must be increased by 43% to compensate for the reduction in friction between the pipe and the backfill material.

4.02.02.03 Joints

Joints shall be bell and spigot with elastomeric rubber gasket conforming to Section 4 of AWWA C900, C905, or C909, as applicable.

4.02.03 Valves

4.02.03.01 Resilient Seated

All resilient seated valves shall conform to AWWA C509 or AWWA C515, Standards for Resilient-Seated Gate Valves for Water Supply Service. The valves shall be fully bronze mounted and shall be furnished with O-ring packing. The direction of the opening shall be to the Owner's standard.

Valves shall be East Jordan Iron Works, Clow Corporation R/W Resilient Wedge, Waterous Resilient Wedge, U.S. Pipe Metroseal 250 or equal.

4.02.03.02 Butterfly Valves

All butterfly valves shall conform to AWWA C504, Standard for Rubber Seated Butterfly Valves. Valves shall be Class 150B and shall have a "short body" form. Valves suitable for buried service will be acceptable without a manhole. Shaft seals shall be replaceable without removing the valve shaft. Valves shall be equipped with totally enclosed worm gear actuators conforming to AWWA C504.

4.02.04 Hydrants

Fire hydrants shall conform to AWWA C502, Standard for Dry Barrel Fire Hydrants. The hydrants shall have two 2-1/2 inch hose connections and 1 pumper connection of standard thread and size of the Owner, 5-inch valve opening, 8-inch I.D. barrel and 6-inch mechanical joint inlet which shall be located five feet six inches (5'-6") below the ground. Joint materials shall conform to those previously specified under ductile iron joints. Operating nut shapes, direction of opening and color shall conform to Owner's standard.

Hydrants shall be placed at high points in water main larger than 8-inch diameter for the purpose of air release. Below-grade air release valves in manholes will not be acceptable.

4.02.05 Valve Boxes

Valve boxes shall be screw type, three sectional, adjustable with round bases with an overall length sufficient to permit the tops to be set flush with the established pavement or ground surface. The box shall be provided with a cast iron lid or cover and marked with the word "WATER". The valve boxes shall be designed to withstand heavy traffic.

4.02.06 Water Service Materials

4.02.06.01 Copper Water Service Pipe

Copper water service pipe shall be in accordance with ASTM Specification B88 for Type K annealed, seamless copper. Unless otherwise approved, water services shall have no unions between the corporation stop and curb stop.

4.02.06.02 Corporation Stops

Corporation stops shall conform to Owner's standards. If Owner does not have a standard, corporation stop shall be ball valve style with compression type copper connection Mueller Company P-25008N, Ford FB1000-NL (compression fitting), or approved equal.

4.02.06.03 Curb Stops

Curb stops shall conform to Owner's standards. If Owner does not have a standard, curb stop shall be ball valve style with compression type copper connections Mueller Company P-25155N, Ford B44-444M-NL, or approved equal.

4.02.06.04 Curb Boxes

Curb boxes shall conform to Owner's standards. If Owner does not have a standard, curb stop box shall be Mueller Company H-10300, Ford EM2-55-56, or approved equal.

4.02.07 Plastic Wrap for Pipe

Where indicated on the drawings or in the specifications, the pipe shall be encased in a seamless polyethylene tube, in accordance with AWWA C105 (ANSI A21.5) of eight (8) mills minimum thickness. The ends of adjacent sections of polyethylene tubing shall be overlapped a minimum of one (1) foot, and the joint taped or otherwise secured to prevent displacement during backfill operations.

4.03 INSPECTION

4.03.01 Shop Inspection

All materials furnished by the Contractor are subject, at the discretion of the Owner, to inspection and approval at the Manufacturer's plant. The inspection in the plant of the manufacturer of materials furnished by the Contractor shall be made at the expense of the Owner.

4.03.02 Field Inspection

All pipe and accessories shall be laid, joined, and tested under pressure for defects and leakage in the manner specified herein and as approved by the Engineer.

4.03.03 Disposition of Defective Material

All material found during the progress of the work to have cracks, flaws, or other defects shall be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed from the site. Any material furnished by the Owner and found defective shall be set aside and removed from the site of the work by the Owner.

4.04 RESPONSIBILITY FOR MATERIAL

4.04.01 Responsibility for Material Furnished by Contractor

The Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacturing or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of defective or damaged installed material discovered prior to the final acceptance of the work.

4.04.02 Responsibility for Material Furnished by Owner

The Contractor's responsibility for material furnished by the Owner shall begin at the point of its delivery to the Contractor. Materials already on the site shall become the Contractor's responsibility on the day of the award of the contract. The Contractor shall examine all material furnished by the Owner at the time and place of delivery to him and shall reject all defective material. Any material furnished by the Owner and installed by the Contractor without discovery of such defects will, if found defective prior to final acceptance of the work, be exchanged for sound material by the Owner. The Contractor, however, shall at his own expense, furnish all supplies, labor, and facilities necessary to remove said defective material and install the sound material in a manner satisfactory to the Engineer.

4.04.03 Responsibility for Safe Storage

The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

4.04.04 Replacement of Damaged Material

Any material furnished by the Owner that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at his own expense.

4.05 HANDLING OF MATERIAL

The Contractor shall use care and proper equipment during the unloading and distribution of water main materials on the job site to insure the materials are not damaged.

Pipe and/or fittings shall not be rolled or skidded off the truck beds against previously unloaded materials.

4.06 ALIGNMENT AND GRADE

4.06.01 General

The water main shall be laid and maintained to the required lines and grades with fittings, valves, and hydrants at the required locations and all valve and hydrant stems plumb. The water main shall have a ten foot (10') horizontal separation and an eighteen inch (18") vertical separation from all sewer piping.

4.06.02 Deviations Occasioned by Other Structures

Whenever obstructions not shown on the drawings are encountered during the progress of the work and interfere to such an extent that an alteration in the drawings is required, the Engineer shall have the authority to change the drawings and order a deviation from the line and grade or arrange with the owners of the structures for the removal, relocation, or reconstruction of the obstructions. If the change in drawings results in a change in the amount of work by the Contractor, such altered work shall be done by written order only on the basis of payment to the Contractor for extra work or credit to the Owner for less work.

4.06.03 Depth of Pipe

All pipe shall be laid with the top of the pipe a minimum depth of five (5) feet below established street centerline grade, and with a minimum cover of five (5) feet below existing grade at the water main, unless specified otherwise. When elevations and grades are provided on the drawings, the Contractor shall install in accordance with those elevations and grades.

4.07 LAYING

4.07.01 Lowering of Water Main Material Into Trench

Proper implements, tools, and facilities shall be provided and used by the Contractor for the safe and expedient completion of the work. All pipe fittings, valves, and hydrants shall be carefully lowered into the trench by means of

suitable tools or equipment, in such a manner as to prevent damage to water main material and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench.

If damage occurs to any pipe, fittings, valves, hydrants, or water main accessories in handling, the damage shall be immediately brought to the Engineer's attention. The Engineer shall prescribe corrective repairs or rejection of the damaged items.

4.07.02 Inspection Before Installation

All pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the Engineer, who will prescribe corrective repairs or rejection.

4.07.03 Cleaning of Pipe and Fittings

All lumps, blisters, and excess coating shall be removed from the bell and spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid.

4.07.04 Laying of Pipe

All dirt or other foreign material shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying. No tools or other articles shall be stored in the pipe at any time.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space.

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

4.07.05 Cutting of Pipe and Connections to Existing Water Mains

The Contractor shall cut the pipe in a straight and uniform manner, at right angles to the axis of the pipe, wherever necessary for placing valves, fittings, or closure pieces without damage to the pipe, and without extra cost to the Owner. The cut ends of the pipe shall be beveled before assembly of the joint.

The method of cutting pipe shall be subject to the approval of the Engineer.

Connection to existing mains shall be done at a time when it will least interfere with normal use of the main. The Contractor shall be responsible for draining water from the closed off section of the existing main so that the connection can be made.

The Contractor shall uncover existing mains at points of connection sufficiently in advance of making the connection to allow verification of the dimensions and elevation of the existing main and shall make any revisions required to the fitting, or obtain special adaptors required for the connection. Existing pipe lines shall be adequately supported during the connection operation and prior to placement of backfill.

The Contractor shall be responsible for preventing contamination of existing water mains while the connection is made. He shall be responsible for any damage caused by his operations to existing mains to which the connections are being made.

4.07.06 Bell Ends to Face Direction of Laying

Pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the Engineer. Where pipe is laid on a grade of 10 percent or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe upgrade.

4.07.07 Ductile/Cast Iron Sleeves

In connecting ductile/cast iron pipe together with a ductile/cast iron sleeve, the space between adjoining ductile/cast iron pipes shall not exceed two (2) inches. Where the space between adjoining ductile/cast iron pipes exceeds two (2) inches, a spacer shall be placed to fill the space. The spacer shall be a piece of ductile iron pipe of the same diameter and class as the adjoining pipe, and shall be cut straight and uniform and be free of defects and damage. In lieu of a spacer, the Contractor may elect to use joint restraining glands on both sides of the sleeve. If restraining glands are used, the pipe shall extend into each end of the sleeve a minimum of one-third (1/3) the length of the sleeve, unless approved otherwise by the Engineer.

4.07.08 Locator Wire

PVC and PVCO water main shall be installed with 12 AGW insulated copper locator wire attached to the pipe at approximately five (5) foot intervals using tape or other suitable methods to assure that the wire is not dislocated during pipe installation and backfilling. All joints shall be soldered and taped or suitably insulated. The locator wire shall be brought to the surface at all hydrant locations and attached to a bottom flange bolt of the hydrant. It shall also be brought to the surface at all valve box locations and shall be mechanically adhered to the inside wall to assure the wire is not dislocated during normal operations.

Prior to acceptance of the water main the Contractor must verify the continuity of the tracer wire in the presence of the Owner or Engineer and repair any breaks in the line.

4.08 JOINING OF MECHANICAL - JOINT PIPE

4.08.01 General Requirements

The general requirements in Section 4.03 - 4.07 inclusive shall apply except that, where the terms "bell" and "spigot" are there used, they shall be considered to refer to the bell and spigot ends of the lengths of mechanical-joint pipe.

4.08.02 Cleaning and Assembly of Joint

The last eight inches (8") outside of the spigot and inside of the bell of mechanical joint pipe shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter from the joint and then coated with a lubricant. The gasket lubricant shall be nontoxic, tasteless, and odorless, and shall be as supplied or recommended by the pipe manufacturer and approved by the Engineer. The retaining gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell, end. The rubber gasket shall be coated with lubricant and placed on the spigot end with the thick edge toward the gland.

4.08.03 Bolting of Joint

The entire section of the pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell; care shall be taken to locate the gasket evenly around the entire joint. The retaining gland shall be moved along the pipe into position for bolting, all of the bolts inserted, and the nuts screwed up tightly with the fingers. All nuts shall be tightened with a suitable (preferably torque-limiting) wrench. The torque for various sizes of bolts shall conform to ANSI/AWWA C600, Standard for Installation of Ductile-Iron Mains and Their Appurtenances, as follows:

Nominal Joint Size Inches	Bolt Size Inches	Range of Torque Foot – Pounds
3”	5/8	45 - 60
4”-24”	3/4	75 - 90
30”-36”	1	100 - 120
42”-48”	1-1/4	120 - 150

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at

all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and last, the remaining bolts. Repeat this cycle until all bolts are within the above range of torques. If effective sealing is not attained at the maximum torque indicated above, the joint should be disassembled and reassembled after thorough cleaning. Over stressing of bolts to compensate for poor installation practice is not allowed.

4.08.04 Permissible Deflection in Mechanical-Joint Pipe

Whenever it is desirable to deflect mechanical-joint pipe in order to form a long radius curve, the amount of deflection shall not exceed the maximum limits shown in Table 1.

TABLE 1

PERMISSIBLE DEFLECTIONS IN MECHANICAL - JOINT PIPE

Size of Pipe Inches	Max. Permissible Deflection Per Length - Inches		Approx. Radius of Curve Produced By Succession of Joints - Feet	
	18'	20'	18'	20'
3	31	35	125	140
4	31	35	125	140
6	27	30	145	160
8	20	22	195	220
10	20	22	195	220
12	20	22	195	220
14	13.5	15	285	320
16	13.5	15	285	320
18	11	12	340	380
20	11	12	340	380
24	9	10	450	500

4.09 JOINING OF PUSH-ON JOINT PIPE

4.09.01 General Requirements

The general requirements in Section 4.03 - 4.07 inclusive shall apply except that, where the terms "bell" and "spigot" are there used, they shall be considered to refer to the bell and spigot of the lengths of push-on joint pipe.

4.09.02 Cleaning and Assembly of Joint

The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket.

The thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot end of the pipe or both.

Gasket lubricant shall be nontoxic, tasteless, and odorless and shall be as supplied or recommended by the pipe manufacturer and approved by the Engineer.

The spigot end of the pipe shall be centered in the bell and forced or pushed home. Smaller sizes of pipe can be pushed or forced into place by hand; larger sizes will require the use of mechanical assistance.

The condition of the trench bottom must be such that location and position of the pipe to be joined is in a straight line assuring a joint of maximum tightness and permanent seal.

4.09.03 Permissible Deflection in Push-On Joint Pipe

Whenever it is desirable to deflect push-on joint pipe in order to form a long radius curve, the amount of deflection shall not exceed the maximum limits shown in Table 2, unless recommended by the pipe manufacturer and approved by the Engineer.

TABLE 2

PERMISSIBLE DEFLECTIONS IN PUSH-ON JOINT PIPE

Size of Pipe Inches	Max. Permissible Deflection Per Length - Inches		Approx. Radius of Curve Produced By Succession of Joints - Feet	
	18'	20'	18'	20'
3	19	21	205	230
4	19	21	205	230
6	19	21	205	230
8	19	21	205	230
10	19	21	205	230
12	19	21	205	230
14	11	12	340	380
16	11	12	340	380
18	11	12	340	380
20	11	12	340	380
24	11	12	340	380
30	11	12	340	380
36	11	12	340	380
42	11	12	340	380
48	-	12	-	380

4.09.04 Brass Wedges

Unless otherwise specified, brass wedges will be required for all push on joint pipe. A minimum of two wedges shall be used at each joint.

4.10 SETTING OF VALVES AND FITTINGS

4.10.01 General Requirements

Valves, fittings, plugs, and caps shall be set and joined to pipe in the manner specified above for cleaning, laying and joining pipe.

4.10.02 Location of Valves

Valves in water mains shall, where possible, be located on the street property lines extended unless shown otherwise on the drawings.

4.10.03 Valve Boxes and Valve Pits

A valve box or a precast concrete chamber shall be provided for every valve.

A valve box shall be provided for every valve that has no gearing or operating mechanism or in which the gearing or operating mechanism is fully protected with a cast-iron grease case. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed.

A precast concrete chamber shall be provided for every valve that has exposed gearing or operating mechanisms. The valve nut shall be readily accessible for operation through the opening in the manhole, which shall be set flush with the surface of the finished pavement or such other level as may be specified. Pits shall be so constructed as to permit minor valve repairs and afford protection to the valve and pipe from impact where they pass through the pit walls.

4.10.04 Dead Ends

All dead ends on new mains shall be closed with ductile iron plugs or caps; such dead ends shall be equipped with suitable blowoff facilities.

4.11 SETTING OF HYDRANTS

4.11.01 Location

Hydrants shall be located as shown or as directed so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.

When placed behind the curb, unless otherwise directed, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than two (2) feet from the face of the curb.

When set in the lawn space between the curb and the sidewalk, or between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within 6 inches of the sidewalk.

4.11.02 Position

All hydrants shall stand plumb and shall have their nozzles parallel with, or at right angles to, the curb, with the pumper nozzle facing the curb, except that hydrants having two hose nozzles 90 degrees apart shall be set with each nozzle

facing the curb at an angle of 45 degrees. Hydrants shall be set to the established grade, with nozzles a minimum of twenty seven (27) inches above the street centerline grade and a minimum of twenty one (21) inches above the ground at the hydrant, unless otherwise directed by the Engineer.

4.11.03 Connection to Main

Each hydrant shall be connected to the main with a 6 inch ductile iron branch controlled by an independent 6 inch gate valve, unless otherwise specified. The cost of the branch pipe shall be incidental to cost of installing the hydrant.

4.11.04 Hydrant Drainage

All hydrant drains shall be plugged unless otherwise directed by the Owner.

4.11.05 Pumping of Hydrants

All hydrants shall be pumped completely dry when the water main is placed in service.

4.12 ANCHORAGE

4.12.01 Restrained Joint Pipe

All ductile iron restrained joint pipe shall be Clow Corporation "Super-Lock"; American Ductile Iron Pipe "Lok-Ring Joint" or “Flex-Ring Joint”; or approved equal. All components of the restrained joint shall be as manufactured, supplied, or recommended by the manufacturer of the restrained joint pipe system actually installed.

4.12.02 Joint Restraining Glands

Joint restraining glands shall be EBAA Iron Sales “Megalug”, Ford “Uniflange Series 1400”, Tyler Union “Tuf-Grip Series 1000” or approved equal.. Joint restraining glands shall not be used to provide restraint to plain end fittings.

4.12.03 Mechanical Joint Anchoring Fittings

Mechanical joint anchoring fittings shall be as manufactured by Clow Corporation, Tyler Corporation, or approved equal.

4.12.04 Anchorage for Hydrants

All hydrants shall be restrained to the hydrant lateral valve, and the hydrant lateral valve shall be restrained to the main using an approved joint restraint system consisting of restrained joint pipe, joint restraining glands, mechanical joint anchoring fittings, or approved equal.

4.12.05 Anchorage for Plugs, Caps, Tees, Bends and Valves

Unless otherwise specified or approved by the Engineer, movement of all plugs, caps, tees, bends, and valves shall be prevented by use of restrained joint pipe or joint restraining glands. When joints are to be restrained with mechanical devices as noted above, all joints shall be restrained for a minimum distance from the fitting as required in the following table.

The use of joint restraining glands to provide restraint to plain end fittings is not an acceptable means of restraint and will not be allowed.

PIPE RESTRAINT LENGTH REQUIRED, FEET

Pipe Diameter	Tees, 90º Bends	45º Bends	22-1/2º Bends	11-1/4º Bends	Dead Ends	Reducers (one size)	**
4"	23	9	5	2	57		
6"	32	13	6	3	82	43	63
8"	41	17	8	4	104	43	55
12"	58	24	12	6	149	80	120
16"	74	31	15	7	192	82	110
20"	89	37	18	9	233	82	104
24"	104	43	21	10	272	82	99
30"	123	51	25	12	328	115	148
36"	141	58	28	14	379	115	140

**If straight run of pipe on small side of reducer exceeds this value, then no restrained joints are necessary.

NOTE: The length of restrained joint pipe required as shown in the table above is based on trench backfill being compacted to 95% of maximum unit weight in accordance with MDOT procedures. If the pipe is wrapped in polyethylene, a greater length of restrained pipe will be required as specified, shown on the Drawings, or directed by the Owner. **A multiplier of 1.43 shall be used if the pipe is installed with polyethylene wrap.**

All joints lying within the above minimum distances from the fitting must be restrained as noted herein.

Tees: Tees shall be restrained in the branch direction as required in the table above. Also, to augment the above, in the straight through direction, the minimum length of the first pipe on either side of the tee shall be ten (10) feet. In

those cases where a valve is placed at the tee, the valve shall be restrained to the tee as noted below, and the next pipe shall be a minimum length of ten (10) feet.
Plugs/Caps: All dead ends on water mains shall be plugged or capped with standard plugs or caps. The water main, including the plug or cap shall be restrained back from the plug or cap as required in the table above.

Bends: Bends shall be restrained in both directions as required in the table above.

Valves: Valves used in conjunction with restrained joint pipe shall be restrained in accordance with the recommendations of the manufacturer of the restrained joint pipe. All valves at crosses or tees shall be restrained to the tee by use of restrained joint pipe or joint restraining glands as specified above. Hydrant valves may be restrained using mechanical joint anchoring fittings.

Secure all fittings with restrained joint pipe or joint restraining glands throughout entire area of muck plus an additional length beyond the muck area in suitable soils for a distance in accordance with this section.

4.12.06 Reaction Backing (Thrust Blocks)

Reaction backing (thrust blocks) shall be used only at locations indicated on the Drawings, or approved by the Engineer.

Reaction backing shall be concrete having a compressive strength of not less than 2,000 psi after twenty-eight (28) days. Backing shall be placed between solid, undisturbed ground and the fitting to be anchored. The area of bearing on the pipe and on the ground in each instance shall be that shown in the table below or directed by the Engineer. The backing shall, unless otherwise shown or directed, be so placed that the pipe and fitting joints will be accessible for repair.

REACTION BACKING

Minimum Bearing Area against undisturbed trench wall, in square feet, for sand is indicated in the table below. Details of placement are shown in Standard Details.

Pipe Size	Tees, Plugs, Wyes, 45 Els	Hydrants, 90 Els	Wyes, 22-1/2 Els or Less
6"	3	3	1
8"	4	6	2
10"	7	9	3
12"	9	11	3
16"	13	20	6
20"	20	28	8
24"	28	40	11

Other Soil Conditions		
Cement Sand or Hardpan	-	multiply above by 0.5
Gravel	-	multiply above by 0.7
Hard Dry Clay	-	multiply above by 0.7
Soft Clay	-	multiply above by 2.0

4.13 HYDROSTATIC TEST

4.13.01 Procedure

All tests will be made by the Contractor using his own equipment, operators, and supervision, in the presence of the Engineer or his duly authorized representative. The length of the section to be tested shall be as approved by the Engineer, or as shown on the drawings. The test shall not be against an existing valve, unless written permission is obtained from the water system operator. In no case shall a test be made against an existing valve that is found to be leaking or otherwise defective. Testing shall be in accordance with AWWA C600.

4.13.02 Air Removal Before Test

Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.

4.13.03 Leakage Test

A leakage test shall be conducted during the hydrostatic pressure test in the presence of the Engineer The contractor shall furnish the pump, pipe, connections, gages and all other necessary apparatus, and shall furnish the necessary assistance to conduct the test. The duration of the test shall be a minimum of 2 hours, and during the test the main shall be subjected to a pressure of 150 psi. When several valved sections are tested as one test, the maximum allowable leakage will be equivalent to the calculated allowable leakage for the smallest valved section therein.

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified leakage test pressure after the air in the pipeline has been expelled, and the pipe has been filled with water. No pipe installation will be accepted if the leakage is greater than that determined by the formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

Where:

L = Allowable leakage, in gallons per hour

S = Length of pipe tested, in feet

D = Nominal diameter of the pipe, in inches

P = Average test pressure during the leakage test, in pounds per square inch (gage).

This formula is based on allowable leakage of 10.49 gallons per day, per mile of pipe, per inch of nominal diameter at 150 psi.

The Owner shall be furnished a written report of the results of the leakage test that identifies the specific length of pipe tested, the pressure, the duration of the test, and the amount of leakage. The report shall be signed by the Contractor and the Engineer.

4.13.04 Variation from Permissible Leakage

If any test of pipe laid discloses leakage greater than that specified above, the Contractor shall at his own expense locate and repair the leaks until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of the allowance used for testing.

4.13.05 Time for Making Test

The pipe may be subjected to hydrostatic pressure and inspected and tested for leakage at any convenient time after the trench has been partially backfilled.

Where any section of the main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least 7 days have elapsed after the concrete reaction backing was installed. If high-early-strength cement is used in the concrete reaction backing, the hydrostatic pressure test will not be made until at least 2 days have elapsed.

4.14 CLEANING AND DISINFECTING

4.14.01 Flushing Water Main

The water main and services three (3) inch diameter and larger shall be flushed by providing taps in sufficient size or number to provide a velocity of 3 feet per second in the line being flushed. Hydrants may be used providing the requirements listed below are met.

4.14.01.01 Procedure

The Contractor shall submit to the Engineer a procedure schedule outlining the method he proposes to use for flushing water mains. Mains shall be flushed at a maximum of 1/4-mile intervals.

4.14.01.02 Time for Flushing

Flushing may be done prior to hydrostatic pressure testing or following hydrostatic pressure testing, but, in any case, prior to chlorination of the water main.

4.14.02 Chlorination

All newly-laid lines shall be chlorinated. The Contractor shall furnish all necessary equipment and materials and shall furnish all necessary assistance for effective disinfection of the water mains. Chlorination shall be accomplished by using the following general procedure.

4.14.02.01 Procedure

Disinfection shall be in accordance with AWWA C651. After the water main has been pressure tested and flushed, the Contractor shall employ one of the following methods to disinfect the new water main:

Continuous Feed Method: the potable water shall be chlorinated so that after a 24-hour holding period in the main, a free chlorine residual of not less than 10 ppm (mg/L) exists in the main.

Slug Method: the water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 100 ppm (mg/L) free chlorine. The chlorine shall be applied continuously and for a sufficient period to develop a solid column, or slug, of chlorinated water that will, as it moves through the main, expose all interior surfaces (including fittings, valves, hydrants,

and other appurtenances) to a concentration of approximately 100 ppm for at least three (3) hours.

The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 ppm, the flow shall be stopped; chlorination equipment shall be relocated at the head of the slug; and, as flow resumes, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 ppm.

The amount of chlorine required for each 100 feet of pipe of various diameters to produce 50 ppm chlorine solution is as follows:

Pipe Sizes (Inches)	100 Percent Chlorine (lb.)	16% Bleach (gal.)
6	0.062	0.046
8	0.110	0.081
10	0.171	0.128
12	0.247	0.18
16	0.439	0.313
24	0.987	0.737
30	1.542	1.100

4.14.02.02 High Test Calcium Hypochlorite

("HTH", "Perchloren", "Pittchlor"). Prepare a ten-thousand-parts-per-million solution in water and pump at a constant rate into the water main while bleeding off the water at the extreme end. The bleed rate will determine the feed rate of the chlorine in order to arrive at a 50 to 100 ppm solution in the water main.

4.14.02.03 Liquid Chlorine

Liquid chlorine may be applied to the water main much the same way as the hypochlorite solution listed above. The rate of application will have to be adjusted for the degree of concentration of the liquid chlorine.

4.14.02.04 Point of Application

The chlorinating agent shall be applied at the supply end of the line through a corporation cock. The water for injecting the chlorine into the new main may be taken from the pressure side of the isolation valve or by utilizing a pressure pump. Care shall be exercised to prevent any of the strong chlorine solution from entering existing water mains.

4.14.02.05 Retention Period

The chlorinated water shall be retained in the new water main according to the requirements of AWWA C651 described in Section 4.14.02.01 of this Specification. The chlorinated water in the new main shall be retained for a period not to exceed 24 hours. In cases where a shorter retention period is necessary, a stronger solution may be used and the retention period reduced accordingly. For these stronger solutions the approval of the Utility's Engineer must be secured in writing as to the length of retention time in relationship to chlorine strength.

While the chlorine solution is in the line, the Contractor shall operate valves and hydrants in the chlorinated section to ensure the complete disinfection thereof.

4.14.02.06 Flushing and Testing

The chlorinated water shall be flushed from the main, fittings, valves, branches, and hydrants at the end of the retention time so that the entire line is clear of any residual chlorine. The environment to which the chlorinated water is to be discharged shall be inspected. If the chlorinated discharge could cause damage to the environment, a neutralizing chemical shall be applied to the water to thoroughly neutralize the residual chlorine.

A sample shall then be taken from the line in the presence of the Engineer. Samples shall be taken for every 1,200 feet of water main installed, and the end of the line, and from each branch. The Engineer shall deliver the sample(s) to a laboratory for bacteriological analysis. In the event that the water sample(s) does not pass this bacteriological test, the chlorination procedure outlined above shall be repeated until the quality of water is substantially the same as that being delivered from the existing distribution system. The test procedure shall be repeated until two consecutive safe results are obtained at each location as required by the Michigan Department of Environment, Great Lakes, and Energy. The two samples shall be taken 24 hours apart. The main shall be re-chlorinated after two (2) failed consecutive tests, whether the test fails at a different sample point or not.

Testing shall be coordinated with laboratory schedules for holidays and weekends.

4.15 MEASUREMENT AND PAYMENT

4.15.01 General

All proposed construction shall be measured for payment by the Engineer in accordance with the items listed in the proposal.

The unit price bid for each proposal item shall be payment in full for completing the work, ready for use as specified.

Removal of existing water main and appurtenances shall be considered incidental to other major items of work unless otherwise noted and provided for by specific proposal items.

All labor, materials, and costs associated with excavation, bedding, and backfill for water main items shall be included in the price of those items unless otherwise noted and provided for by specific proposal items.

All labor, materials, and costs associated with flushing, chlorination, and testing shall be considered incidental to other major items of work unless noted otherwise.

4.15.02 Water Main

Measurement of the length of the main shall be in lineal feet along the centerline of the main through any fittings along the length being measured and shall include any joint restraint or polyethylene encasement required.

4.15.03 Hydrants

Hydrants shall be measured as single units including all connective piping, joint restraint, and extensions required to bring the hydrant to proper grade.

4.15.04 Fittings

Fittings such as bends, tees, crosses, plugs, reducers, and sleeves shall be measured as single units and shall include any joint restraint required.

When no proposal item is provided, the work shall be considered part of the major items of work.

4.15.05 Valves

Valves will be measured as single units and shall include valve box, joint restraint, and other materials as required for installation of the valve and valve box.

4.15.06 Taps

Taps for either water valves or water services shall be considered part of the major items of work and no specific payment will be made therefor unless otherwise provided for in the proposal.

4.15.07 Thrust Block

Thrust blocks shall be measured as single units and shall include removal of existing thrust blocks.

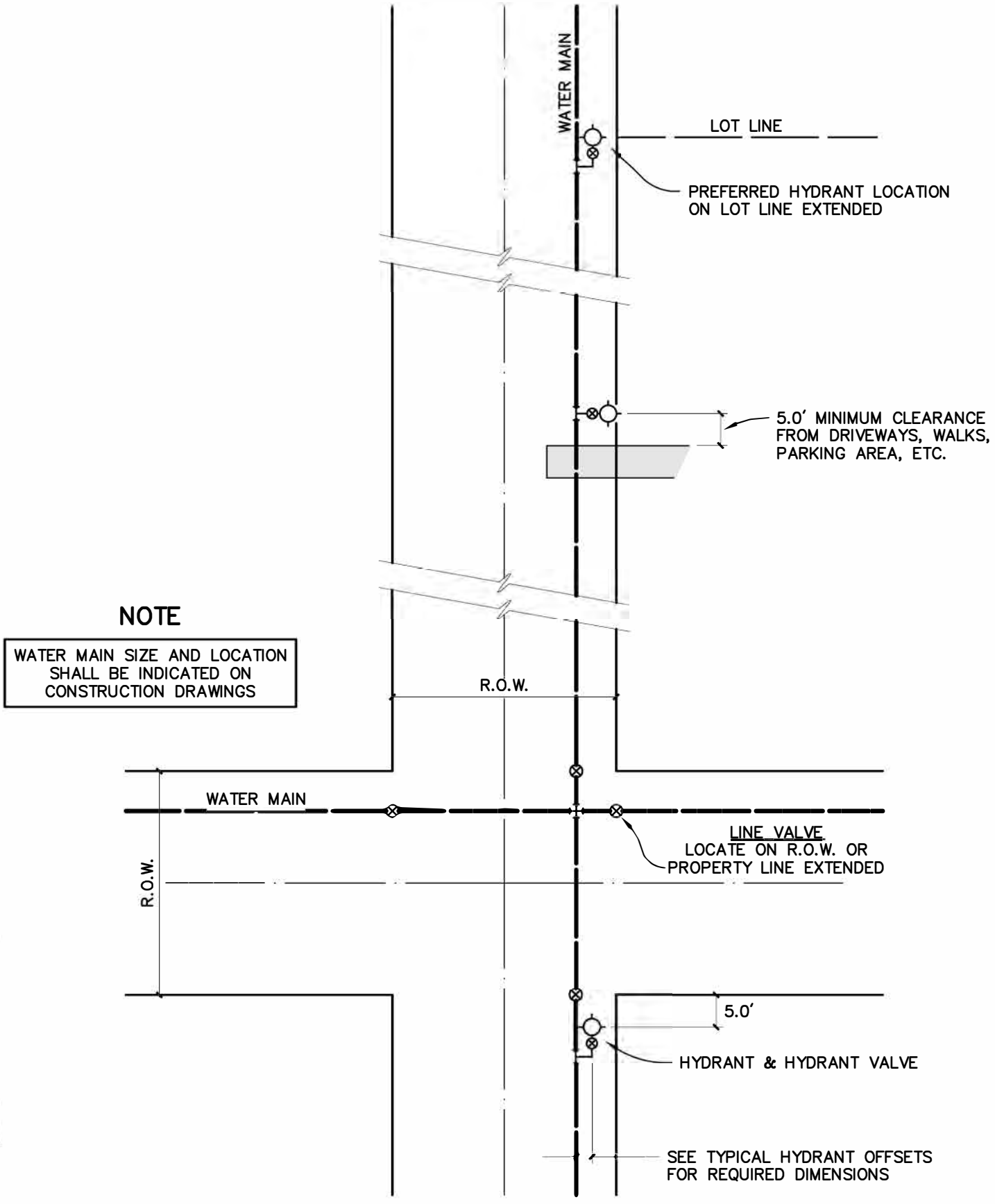
When no proposal item is provided, the work shall be considered part of the major items of work.

4.15.08 Water Services

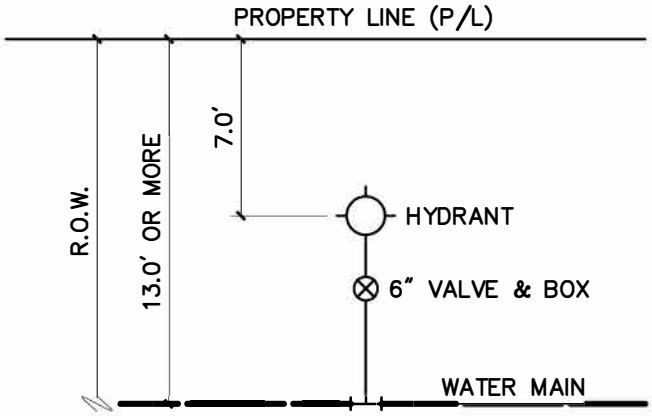
Measurement of the length of the service shall be in lineal feet along the centerline of the service through any fittings along the length being measured.

Corporation Stops will be measured in single units and include the tap of the water main.

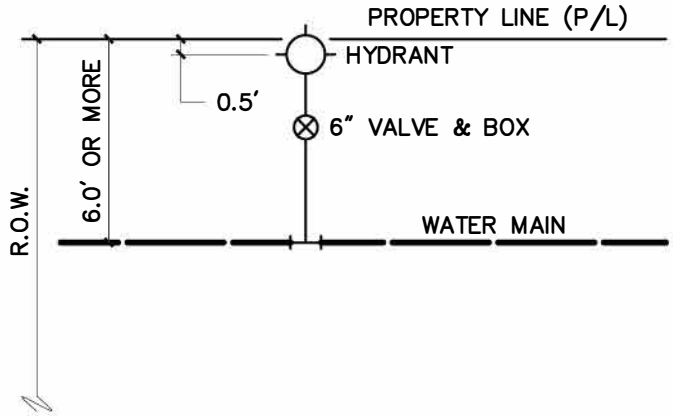
Curb Stops will be measured in singe units and include the stop box.



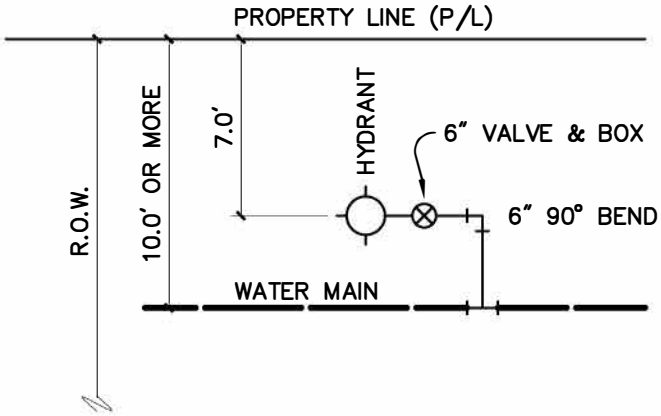
VALVE & HYDRANT LOCATIONS



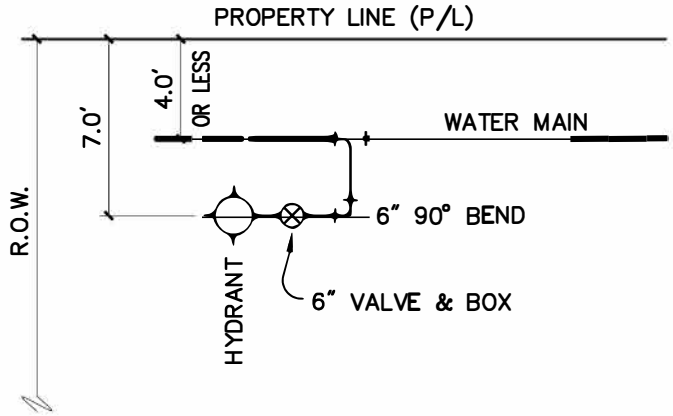
Ⓐ WATER MAIN MORE THAN 13.0' FROM P/L
HYDRANT LOCATED AT 7.0' FROM P/L



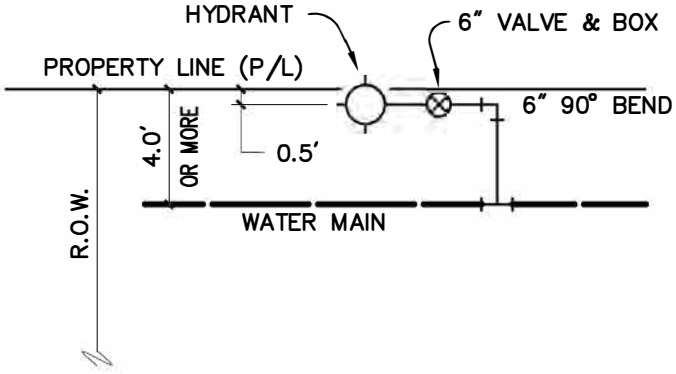
Ⓑ WATER MAIN MORE THAN 6.0' FROM P/L
HYDRANT LOCATED AT 0.5' FROM P/L



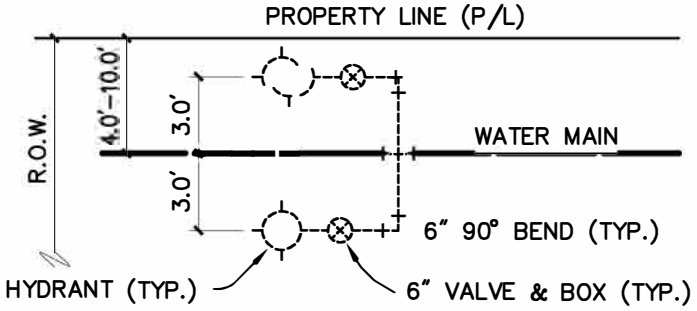
Ⓒ WATER MAIN MORE THAN 10.0' FROM P/L
HYDRANT LOCATED AT 7.0' FROM P/L
(WHEN REQUIRED BY OWNER)



Ⓓ WATER MAIN LESS THAN 4.0' FROM P/L
HYDRANT LOCATED AT 7.0' FROM P/L

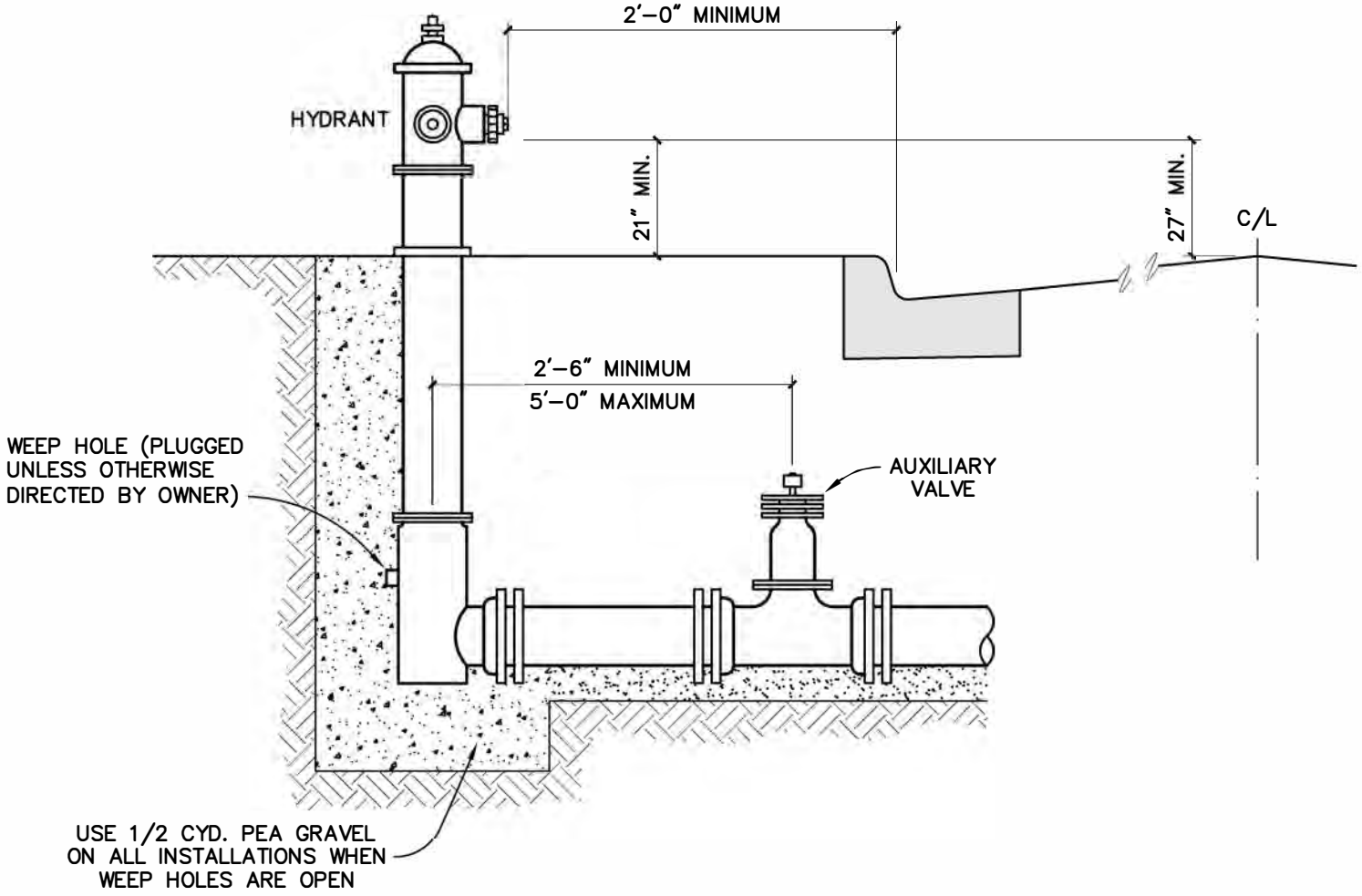


Ⓔ WATER MAIN MORE THAN 4.0' FROM P/L
HYDRANT LOCATED AT 0.5' FROM P/L

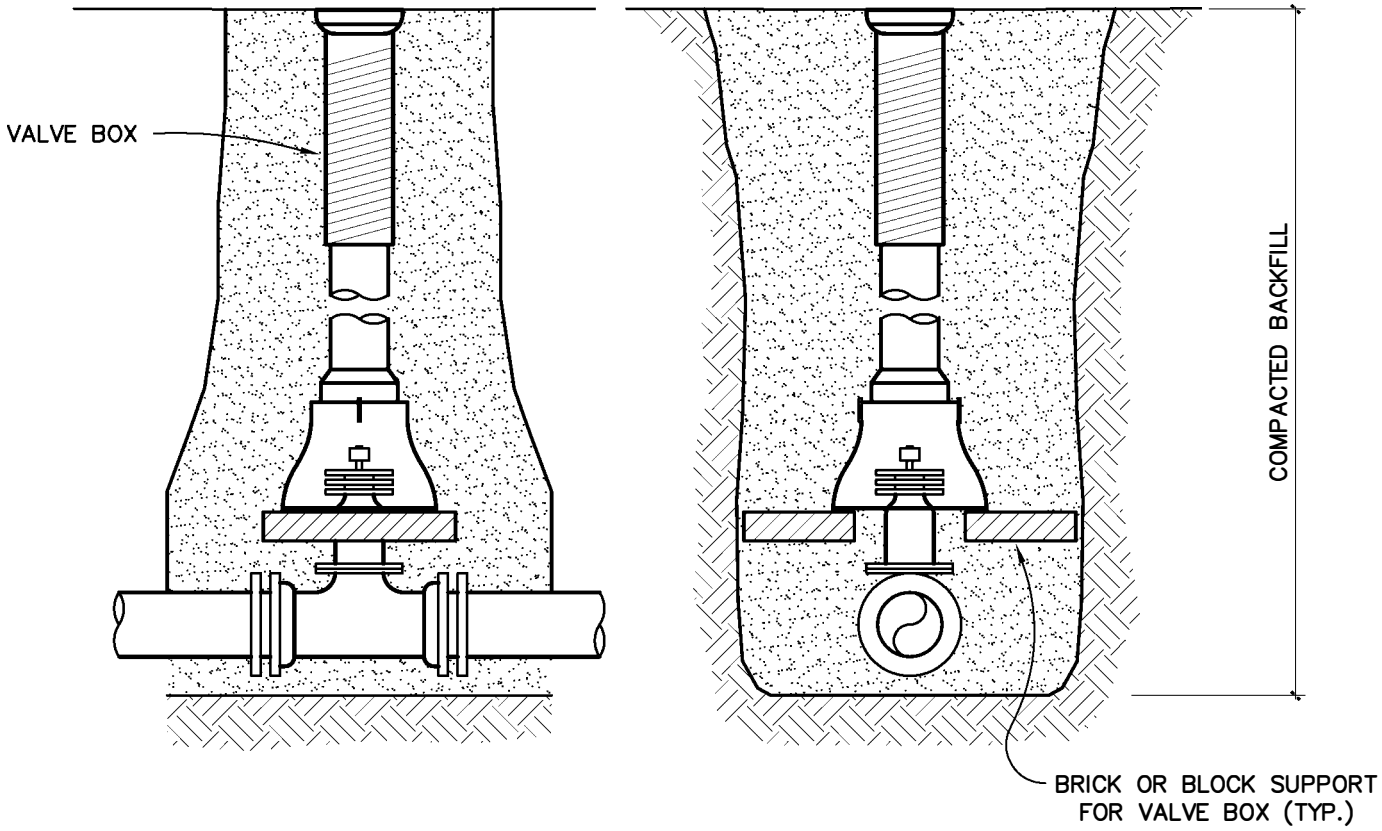


Ⓕ WATER MAIN BETWEEN 4.0' & 10.0' FROM P/L
HYDRANT LOCATED AT 3.0' FROM P/L

HYDRANT OFFSETS



HYDRANT DETAIL



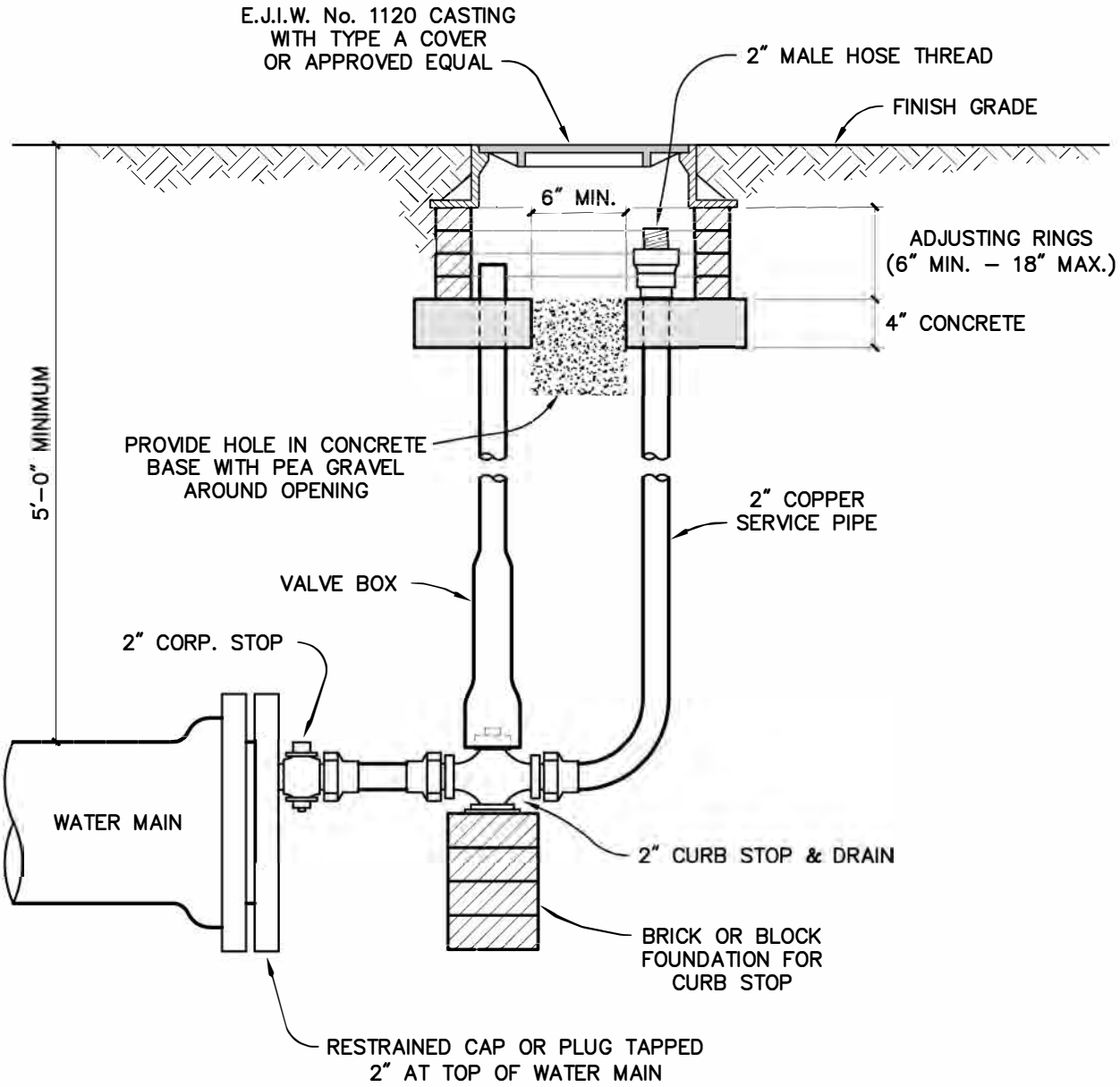
SIDE VIEW

FRONT VIEW

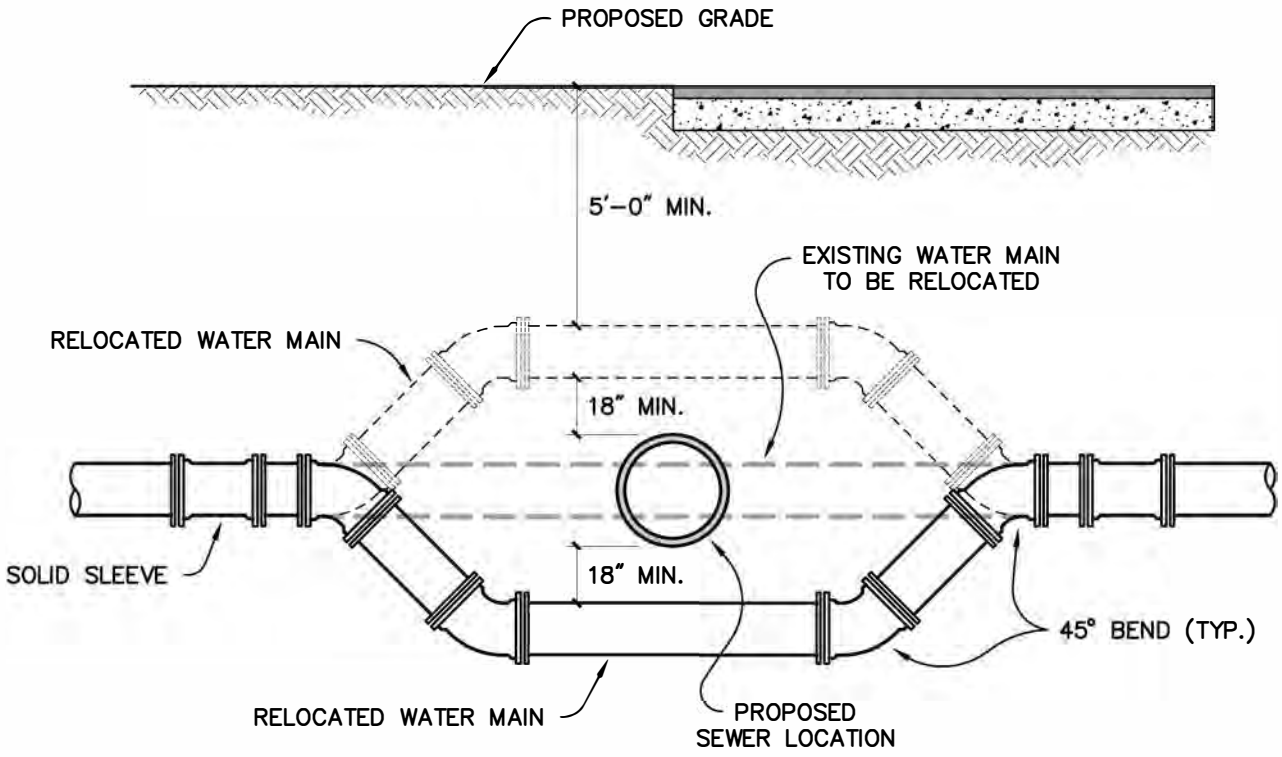
VALVE & BOX FOUNDATION

NOTE

VALVE BOX AND SUPPORTS SHALL NOT BE IN CONTACT WITH VALVE OR PIPE. MAINTAIN MINIMUM 2" CLEARANCE.



BLOW OFF DETAIL



WATERMAIN RELOCATION DETAIL

NOTE

WHEN THE MINIMUM CLEARANCE AND COVER CAN BE OBTAINED, THE WATER MAIN IS TO BE RELOCATED ABOVE THE SEWER.

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SECTION 5

SPECIFICATIONS FOR STORM SEWER

5.01 DESCRIPTION OF WORK

The work shall consist of furnishing and installing storm sewer pipe of the specified size or sizes in a trench and shall include the construction of manholes, catch basins, and other appurtenant work. Excavating, trenching and backfilling shall be as specified in Section 2.

The work shall be performed in accordance with the specifications and drawings, the MDOT 2020 Standard Specifications for Construction and the following specifications.

5.02 MATERIALS

All materials furnished by the Contractor shall conform to the specifications which follow. Where reference specifications are used, they shall be considered as referring to the current edition or latest issue.

5.02.01 Sewer Pipe

All sewer pipe shall be of the materials and strengths shown on the Drawings or as specified.

5.02.01.01 Reinforced Concrete Sewer Pipe

Reinforced concrete sewer pipe, fittings, and accessories shall conform to the requirements of ASTM Designation C76 for the various classes specified.

Unless otherwise specified, joints for reinforced concrete sewer pipe shall be premium rubber joints conforming to the requirements of ASTM Designation C443.

5.02.01.02 Nonreinforced Concrete Pipe

Nonreinforced concrete pipe, fittings, and accessories shall conform to the requirements of ASTM Designation C14, Class 3, unless otherwise specified.

Unless otherwise specified, joints for non-reinforced concrete sewer pipe shall be premium rubber joints conforming to the requirements of ASTM Designation C443.

5.02.01.03 Reinforced Concrete Elliptical Pipe

Reinforced concrete elliptical pipe, fittings, and accessories shall conform to the requirements of ASTM Designation C507 for the various classes specified.

Unless otherwise specified, joints for reinforced concrete elliptical pipe shall conform to one of the following requirements:

Premium joints shall conform to one of the following requirements:

External sealing bands conforming to the requirements of ASTM Designation C877,

Soil tight joints shall conform to the following requirements:

Bituminous mastic conforming to the requirements of Section 909.09 of the MDOT 2020 Standard Specifications of Construction shall completely fill the annular space in the joint. Any excess mastic squeezed into the interior of the conduit shall be troweled smooth.

The joint surface shall also be evenly wrapped with a three (3) foot wide geotextile fabric meeting the requirements of Section 910.03A of the MDOT 2020 Standard Specifications of Construction, Geotextile Blanket for pipe wrap.

Geotextiles shall be stored, handled, and placed in accordance with the manufacturer's recommendations. Torn or punctured geotextiles shall not be used. Geotextile fabric which has deteriorated due to ultraviolet exposure (sunlight) during storage or has been damaged in placing will be rejected.

5.02.01.04 Reinforced Concrete Box Culverts

This section covers precast reinforced concrete box culverts and joints to be furnished and installed as specified and as shown on the drawings.

Box culverts shall be furnished and installed complete with all fittings, specials, jointing materials, and other necessary appurtenances.

Except as modified or supplemented herein, the manufacture and design of concrete box culvert shall be governed by the requirements of ASTM C1433, as applicable.

Unless otherwise specified herein, all materials used in the manufacture of culvert, fittings, and accessories shall conform to the requirements of ASTM C1433, as applicable.

Unless otherwise specified, joints for reinforced concrete box culverts shall conform to one of the following requirements:

Premium joints shall conform to one of the following requirements:

External sealing bands shall conform to the requirements of ASTM Designation C877. The width of the bands shall be thirteen (13) inches. External sealing bands shall be installed in accordance with the sealing band manufacturer's recommendations. Care shall be taken to ensure stretch of the band along the bottom surface of the conduit, and to prevent pulling of the sealing band into the bottom of the joint, by keeping the weight of the conduit off of the bedding until the sealing band is fully installed.

Soil tight joints shall conform to the following requirements:

Bituminous mastic conforming to the requirements of Section 909.09 of the MDOT 2020 Standard Specifications of Construction shall completely fill the annular space in the joint. Any excess mastic squeezed into the interior of the conduit shall be troweled smooth.

The joint shall surface shall also be evenly wrapped with a three (3) foot wide geotextile fabric meeting the requirements of Section 910.03A of the MDOT 2020 Standard Specifications of Construction, Geotextile Blanket for pipe wrap.

Geotextiles shall be stored, handled, and placed in accordance with the manufacturer's recommendations. Torn or punctured geotextiles shall not be used. Geotextile fabric which has deteriorated due to ultraviolet exposure (sunlight) during storage or has been damaged in placing will be rejected.

Except for fittings, bends, tees, and closure pieces, each piece of culvert shall be not less than six (6) feet long. Shorter length to help align precast holes may be allowed with the approval of the Engineer.

Joints shall conform to ASTM C1433, as applicable. Joint design shall be suitable for the joint sealing material to be used.

The total area of longitudinal steel reinforcement shall meet or exceed ASTM C1433. Longitudinal reinforcement shall be spaced uniformly around the culvert, and shall be continuous in each cage.

In no case shall the cover over the reinforcement be less than 5/8 inch, as measured from the internal surface or the external surface of the culvert, except the cover over the reinforcement for the external surface of the top slab of box culverts with less than two (2) feet of cover shall not be less than 1-5/8 inches.

In addition to the requirements of ASTM C1433, as applicable, each culvert and fitting shall have plainly and permanently marked thereon:

Identification of specials to show the location in the line.

On bends, the angle turned.

All bends, tees, closure pieces, wall fittings, end sections, and other fittings which are indicated on the drawings, or required to complete the work shall be furnished. Except as modified or otherwise provided herein, the design and manufacture of fittings shall be governed by the same requirements as the connecting culvert.

Concrete box culverts shall not be delivered to the site until concrete control cylinders representing such culverts shall have attained a compressive strength of at least eighty (80) percent of the specified minimum twenty-eight (28) day strength.

Concrete culvert and fittings shall be handled carefully and shall not be bumped or dropped. Hooks shall not be permitted to come in contact with joint surfaces. Use of lifting holes will be permitted with a minimum of four holes. Holes shall be plugged with non-shrink grout or other means acceptable to the Engineer, after installation.

Bedding for concrete box culverts shall be at least twelve (12) inches below the bottom of the box culvert on rock, and at least six (6) inches below the bottom of the box culvert laid on stable earth. The bedding shall be aggregate, thoroughly compacted to not less than ninety-five (95) percent of maximum unit weight – ninety-eight (98) percent if within the roadway influence – in accordance with MDOT procedures. Bedding material shall conform to the requirements of MDOT for 6A aggregate, or crushed concrete meeting the requirements for 22A aggregate, or approved equal. Bedding material shall extend a minimum of one (1) foot beyond the outside faces of the culvert.

Culvert laying shall begin at the lowest elevation, with the female ends facing the direction of laying, except when reverse laying is permitted by the Engineer.

The interior of all culvert and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted. All joint contact surfaces shall be kept clean until the joint is completed.

Jointing of precast concrete box culvert shall be as specified. Joints shall not be made when weather conditions may interfere with obtaining a satisfactory seal.

The gap width between successive box culvert sections after placement shall be a maximum of 3/4 inch at the nearest surfaces of the joint, and two (2) inches maximum at any other location as measured on the interior exposed edge of the joint. This permissible tolerance shall not affect the lines and grades and their permissible tolerances as shown on the drawings and specified.
Box culverts delivered to the job site with any patching shall not be accepted. If the Contractor wishes to seek acceptance for a patched box culvert, it must be

inspected by the Engineer prior to patching at the point of manufacture, and accepted subject to an approved method of patching.

Drawings, specifications, schedules, and other data showing complete details of the fabrication and construction of box culvert and fittings, together with complete data covering all materials proposed for use, shall be submitted for approval. The drawings and data shall include, but not be limited to, the following for each size culvert:

Details of joints.

Details of fittings and specials.

Details of end sections and tees.
Test reports.

Laying schedules.

Details of reinforcement at openings in the top or sides of the box culvert.

5.02.01.05 Corrugated Metal Pipe

Corrugated metal pipe shall conform to the applicable requirements of Sections 401 and 402 of the MDOT 2020 Standard Specifications of Construction for the various types and gauges specified.

Premium soil tight joints will be required.

5.02.01.06 Smooth Lined Corrugated Polyethylene Pipe

Smooth Lined Corrugated Polyethylene Pipe in sizes up to forty-eight (48) inch diameter shall conform to the requirements of AASHTO M-294, Type S. The material shall have a minimum resin cell classification of 335420 C as determined under ASTM Designation D3350. Pipe shall have annular corrugations, and joints shall have integral bell & spigot with gaskets. Gaskets shall be placed in annular corrugations. Gaskets shall be solid cross section rubber seals conforming to ASTM Designation F477. A protective removable shrink wrap material shall be placed on all exposed gaskets at the factory. Gaskets and sleeves shall be lubricated prior to insertion as required by the pipe manufacturer. Pipe fittings shall conform to AASHTO M-294. Installation and testing shall be as required in Section 2, "Excavating, Trenching, and Backfilling for Utilities", except a minimum of three (3) feet of cover shall be maintained over any pipe during construction staging when construction equipment is crossing the pipe. The cost of temporary cover shall be incidental to the item of work.

5.02.01.07 Polyvinyl Chloride (PVC) - (Roof Drain Laterals Only)

Solid wall PVC plastic pipe shall be extra strength conforming to the requirements of ASTM D3034, with a standard dimension ratio of 23.5 (SDR-23.5).

Joints for PVC plastic may be chemically welded. Manufacturers are required to "guide line" the uncoupled end of each joint of pipe so that in the field, it can be visually determined that the joint is properly made up.

Joints for PVC shall be integral bell & spigot design.

Polyvinyl Chloride (PVC) solid wall schedule 80, ASTM D1785, is also permitted.

5.02.02 Roof Drain Laterals

All roof drain laterals shall be extra strength pipe, and unless otherwise specified, shall be of any material specified in Paragraph 5.02.01. Where bends or curves are specified they shall be smooth long radius type curve. No mitered or segmented type bends will be approved.

5.02.03 Wyes and Tees

Wyes and Tees shall be cast fittings of the same material and joints as the main sewer, or may be an approved fabricated special fitting which provides a suitable connection for the lateral to the main sewer.

Details of special fittings and/or adaptors for connecting laterals of a material different from the main sewer shall be approved by the Engineer before they are manufactured.

Wyes and tees will be required as follows:

6" Wyes on main sewer of 8" or 10" diameter;
6" Wyes or Tees on main sewer of 12" diameter or larger.

5.02.04 Plugs and Stoppers

Plugs or stoppers for plugging the ends of laterals, risers or storm sewers, which are not extended shall make a water tight seal. Design shall be such that they can be readily removed without damage to the pipe.

5.02.05 Underdrains

Materials for underdrains shall conform to the requirements of Section 404 of the MDOT 2020 Standard Specifications of Construction.

5.02.06 Cement Mortar

Mortar shall consist of one part of Air Entraining Portland Cement, and two parts of masonry sand. These proportions shall be measured by volume.

The sand and cement shall be mixed dry in a clean tight box until a mixture of uniform color is produced, after which water shall be added until the required consistency is obtained. Mortar shall be mixed only in such quantities as needed for immediate use. The retempering of mortar will not be permitted.

5.02.06.01 Cement

Air Entraining Portland Cement shall conform to the requirements for Type 1A of the MDOT 2020 Standard Specifications for Construction for Air Entraining Portland Cement, ASTM Designation C150.

5.02.06.02 Masonry Sand

Masonry Sand shall conform to the requirements of "Natural Sand, 2MS" of the MDOT 2020 Standard Specifications for Construction.

5.02.06.03 Water

Water for mixing mortar shall be obtained from the public water supply unless otherwise approved by the Engineer.

5.02.07 Concrete

Concrete for pipe encasement, special pipe embedment, manhole bases and similar items shall meet the requirements of the 2020 MDOT Standard Specifications for Construction for Grade 3000 concrete. Grade 3000 concrete shall have the strength of 3,000 psi at 28 days.

5.02.08 Manhole and Catch Basin Materials

5.02.08.01 Adjusting Rings

Precast grade adjusting rings shall conform to the requirements of ASTM Designation C478.

5.02.08.02 Precast Units

Precast reinforced concrete manhole risers and precast reinforced concrete manhole conical top sections shall conform to the requirements for reinforced concrete manhole risers and tops, ASTM Designation C478.

Joints for precast sections shall be premium rubber, butyl rubber composition seals, "RAM-NEK", or approved equal.

5.02.08.03 Castings

Castings shall meet the requirements specified in the MDOT 2020 Standard Specifications for Construction Section 908. Manhole covers and rings and similar combinations of castings shall be machined to provide an even bearing.

Unless otherwise specified, manhole castings shall be EJ No. 1120 with Type A solid cover, or approved equal.

Unless otherwise specified, catch basin castings at curb inlets shall be EJ No. 7020, with Type M2 grate and Type T1 back, or approved equal.

5.02.08.04 Steel Reinforcement

Steel reinforcement shall conform to the requirements for steel reinforcement of Section 905 of the MDOT 2020 Standard Specifications for Construction.

5.02.08.05 Manhole Steps

Unless otherwise specified, manhole steps shall be plastic coated steel steps conforming to the requirements of ASTM Designation C478, or approved equal, spaced at 16" on center.

5.03 INSPECTION OF MATERIALS BY CONTRACTOR

It shall be the responsibility of the Contractor to inspect all materials for cracks, flaws or other defects before they are incorporated into the work. Any materials found to be defective or damaged, shall be promptly removed from the job site.

5.04 LAYING PIPE

5.04.01 Alignment and Grade

5.04.01.01 Laser Method

The Contractor shall use the laser beam method of maintaining line and grade for sewer construction, unless otherwise approved by the Engineer. The Contractor shall submit evidence to the Engineer that a qualified operator will handle the laser beam equipment during the course of construction.

The Engineer shall place line and grade stakes at each manhole, or more often, as determined by the Engineer. The Contractor shall check the line and grade at very point at which a stake has been placed.

5.04.02 Handling

Pipe shall be protected during unloading and handling against impacts, shocks and free fall. Pipe handled on skid-ways shall not be skidded or rolled against pipe already on the ground.

Pipe shall be carefully lowered into the trench in such a way as to avoid danger to the workmen or damage to the pipe.

5.04.03 Direction of Laying

Excavation of trenches and laying of pipe shall begin at the outlet for the sewer and proceed upgrade with the individual pipe being laid with the spigot end downstream.

5.04.04 Placing

Unless otherwise specified, installation of precast concrete sewer, storm drain, and culvert pipe shall conform to the requirements of ASTM Designation C1479, as applicable.

The pipe shall be placed on the prepared sub-grade and held firmly in place during subsequent pipe jointing and embedment operations. Successive pipes shall be carefully positioned so that when laid they form a sewer with a uniform invert true to line and grade.

Sufficient pressure shall be applied by an approved method to each pipe as it is laid to ensure that the spigot is all the way home in the bell. Care shall be exercised to prevent joints from opening up as successive lengths of pipe are placed. The Contractor shall take the necessary precautions when using a trench box to prevent joint separation when the box is pulled ahead.

5.04.05 Cleaning Sewer

The interior of the sewer shall be cleaned of all jointing material, dirt and debris as the work progresses.

In small sewers where cleaning after laying may be difficult, a swab or drag may be required in the pipe line to satisfactorily complete this work. Where possible, a plug shall be installed on the downstream end of the sewer to prevent any sand and debris from entering the existing sewer.

5.05 PIPE JOINTS

Pipe joints shall be made in strict accordance with the pipe manufacturer's recommendations unless otherwise specified herein. All lubricants, gaskets and other materials required to make the joints shall be supplied or recommended by the pipe manufacturer and approved by the Engineer.

Pipe layers shall be fully qualified and experienced in the work being performed and shall check each joint after it is completed to see that no part of the joint material is left on the inside of the pipe and that the joint is properly made.

5.06 LOCATION OF WYES AND TEES

The approximate locations of wyes or tees are shown on the Drawings. These locations may be adjusted where necessary to best serve the various properties. Exact locations will be determined by the Engineer before the wyes or tees are installed.

The Contractor shall keep an accurate record of measurements from the nearest downstream manhole to each wye or tee which is installed, the length of each lateral, and the depth at the end of each lateral. These measurements shall be recorded on the record drawings to be furnished by the Contractor.

5.07 ROOF OR FOOTING DRAIN LATERALS

5.07.01 General

Installation of roof/footing drain laterals shall meet all requirements specified for storm sewers. All laterals shall be inspected by the Engineer before the trench is backfilled. The end of all laterals shall be properly sealed with a standard stopper or plug, unless directed otherwise by the Engineer.

5.07.02 Length

All roof/footing drain laterals shall be laid at right angles to the storm sewer main line and shall extend to a point one foot outside the street right-of-way (property line) unless otherwise directed. No payment will be made for pipe laid beyond this point unless specifically ordered by the Engineer.

The Contractor shall measure and record the horizontal length of the lateral from the main line sewer to the end of the lateral and provide this information to the Engineer.

5.07.03 Grade

The roof/footing drain lateral shall be laid with a rise of one-quarter (1/4) inch per foot unless otherwise directed.

5.07.04 Markers and Measurements

After installation of the roof/footing drain lateral, but prior to backfilling, the Contractor shall provide and install a 2" x 2" wood marker for each service. The wood markers shall be set vertically from the end of the lateral to twelve (12) inches above finish surface elevations. Also, a 1/2" diameter by 3' long metal stake shall be placed vertically and adjacent to the wood marker with 6" cover. The

Contractor shall assist the Construction Observer in locating the end of each lateral and in recording the location by measuring to the nearest downstream manhole.

After the record locations have been recorded and checked by the Construction Observer, the Contractor shall cut off the markers as follows: in improved areas, the markers shall be cut off two inches below grade; and in undeveloped areas, the markers shall be cut off six inches above grade.

5.08 MANHOLE AND CATCH BASIN CONSTRUCTION

Manholes and catch basins shall be constructed in accordance with the standard details and as specified herein.

Unless otherwise specified, or approved by the Engineer, all manholes and catch basins shall be precast.

Precast bases shall be installed on the subbase in such a way as to provide a uniform bearing under the manhole base.

Precast concrete adjusting rings shall be used to bring existing and new drainage structure covers within the proposed pavement to grade. After the cover is brought to grade, the entire hole created by excavating to raise the casting shall be filled in three-inch (3") lifts with Hot Mix Asphalt Mixture 3C or 13A to the top of the leveling course and air tamped to achieve proper compaction. Special care shall be taken to prevent debris from entering sewers.

Precast manholes and catch basins with integral bottom and channel may be used; however, any changes to the structure due to minor field adjustments of alignment and/or grade required to meet construction conditions, shall be made by the Contractor at no additional cost to the Owner.

Stubs shall be provided in manholes for future connections as shown on the Drawings or as directed by the Engineer. All such stubs shall be sealed with standard plugs or brick bulkheads, in accordance with Section 403.03 of the MDOT 2020 Standard Specifications for Construction.

5.09 CUT-INS

When cutting into an existing manhole, the opening shall be no larger than is necessary to admit the new sewer. All broken or surplus materials falling inside the structure shall be removed. The opening around the pipe shall then be properly sealed with brick and mortar or by other approved means which will result in a water tight and durable repair to the structure.

Flow channels shall be constructed as specified or as directed to accommodate the sewer being cut in.

Cut-ins to existing manholes shall be considered included in the major items of work and no specific payment will be made therefor.

5.10 ACCEPTANCE TESTS

5.10.01 Alignment and Grade

Each section of sewer may be checked by the Engineer for alignment and grade using lights and mirrors, television inspection, or other similar means. The Contractor shall assist the Engineer in the performance of these tests when necessary.

5.10.02 Pipe Deflection Tests (Flexible Pipe Only)

Flexible pipe is any pipe having a pipe stiffness of less than 115 psi. as defined under the requirements of ASTM Designation D2412.

The completed installation of flexible pipe shall at no point have out-of-round deflections in the main sewer pipe greater than five percent (5%) of the pipe's actual original inside diameter. Go/no go gauging tests, using an approved pointed mandrel with a minimum of nine (9) points, shall be performed by the Contractor in the presence of the Engineer, or his authorized representative after the trench is backfilled and before the surface restoration is begun. Pipe with deflections greater than five percent (5%) shall be re-laid by the Contractor at no additional expense to the Owner. Use of mechanical devices or equipment to complete the go/no go tests and vibratory re-rounding of failed sections are prohibited. A minimum of 30 days shall elapse between installation with backfilling and deflection testing.

5.11 MEASUREMENT AND PAYMENT

5.11.01 General

All proposed construction shall be measured for payment by the Engineer in accordance with the items listed in the proposal.

The unit price bid for each proposal item shall be payment in full for completing the work, ready for use as specified.

5.11.02 Storm Sewers

Measurement of the length of the sewer shall be in lineal feet along the centerline of the sewer from center to center of manhole or catch basin structures.

Where depth classifications are provided, the depth of the sewer connecting two adjacent structures shall be considered as being the average of the depth from earth grade to the sewer invert at these structures.

5.11.03 Manholes and Catch Basins

Manholes and catch basins shall be paid for in accordance with the units established in the proposal. When no proposal item is provided for castings, the work shall be considered part of the major items of work.

5.11.04 Wyes or Tees

When a specific item is provided in the proposal for Wyes or Tees the unit price bid shall be the additional cost of furnishing and placing the wye or tee over and above the cost of furnishing and laying the sewer pipe.

When no proposal item is provided, the work shall be considered part of the major items of work.

5.11.05 Roof or Footing Drain Laterals

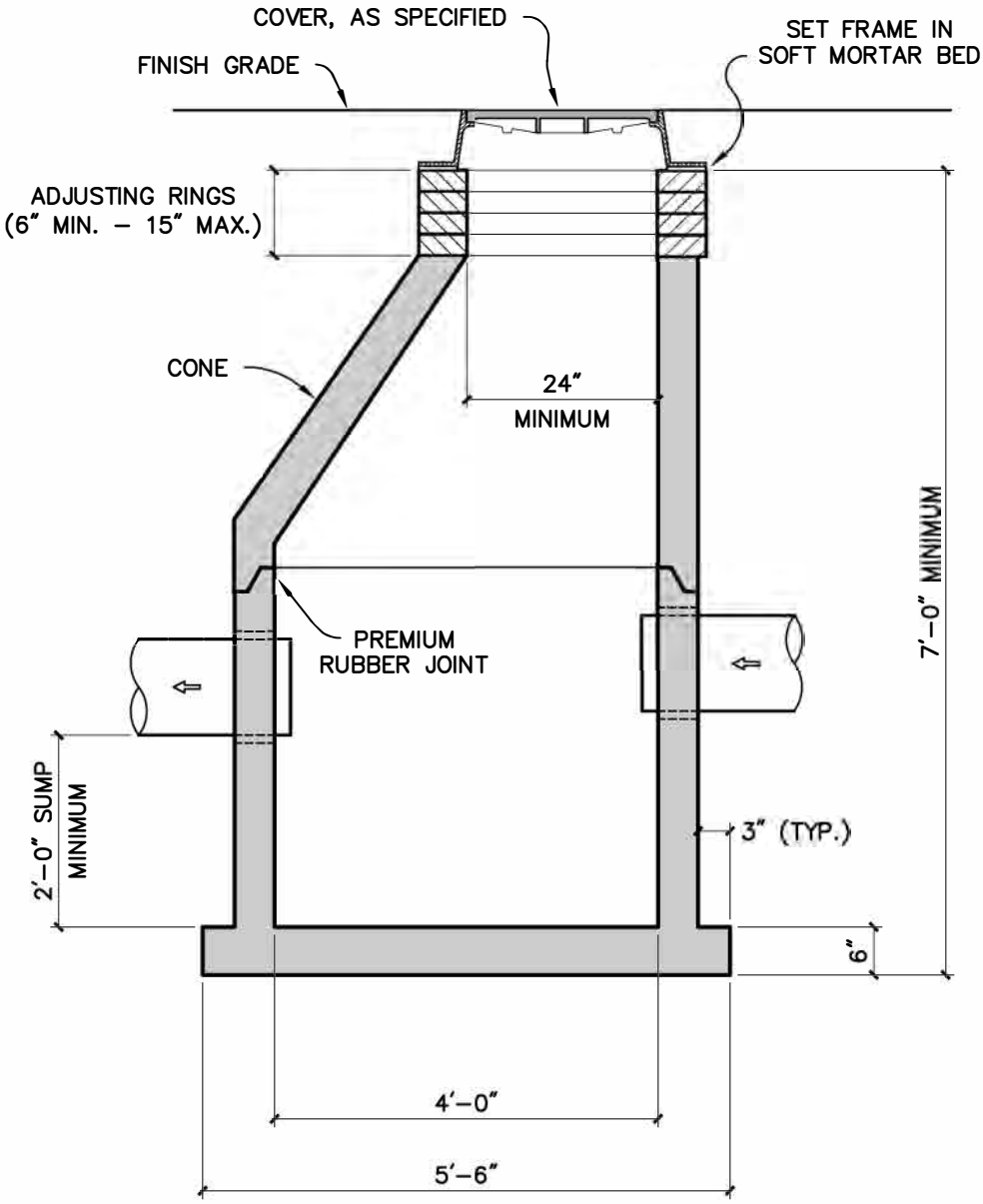
The length of roof/footing drain laterals shall be measured horizontally from the center of the main sewer to the end of the lateral as specified.

5.11.06 Cut-Ins

Cut-ins shall be considered part of the major items of work and no specific payment will be made therefor.

5.11.07 Stubs

Stubs shall be considered part of the major items of work and no specific payment will be made therefor.

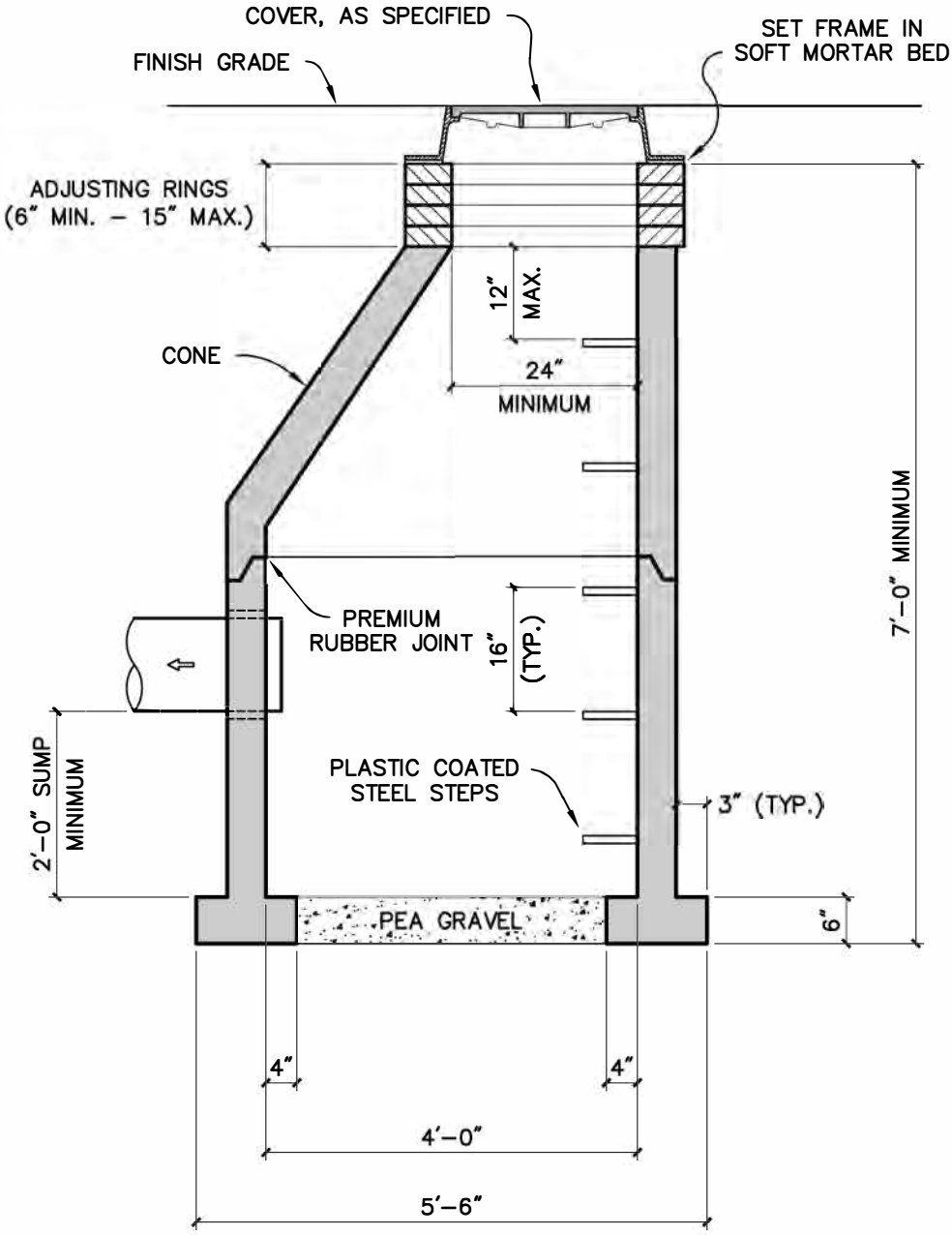


STANDARD CATCH BASIN

(PRECAST CONCRETE)

NOTES

1. PRECAST CONCRETE CATCH BASIN SHALL MEET ASTM C478.
2. IF BOTTOM IS PRECAST CONCRETE, SET ON MINIMUM 4" SAND SUBBASE (CIP) OR CLASS 1A CRUSHED STONE WRAPPED WITH GEOTEXTILE FABRIC.
3. STD. 4'–0" DIAMETER INLET SAME AS CATCH BASIN WITHOUT SUMP.

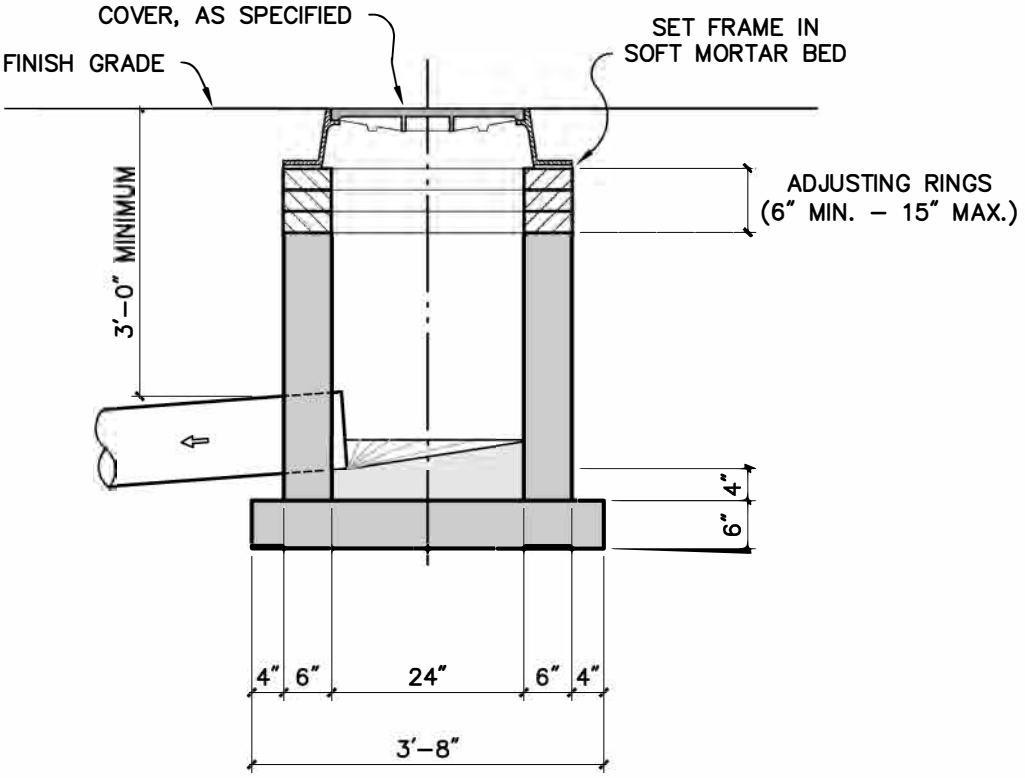


DRYWELL CATCH BASIN

(PRECAST CONCRETE)

NOTES

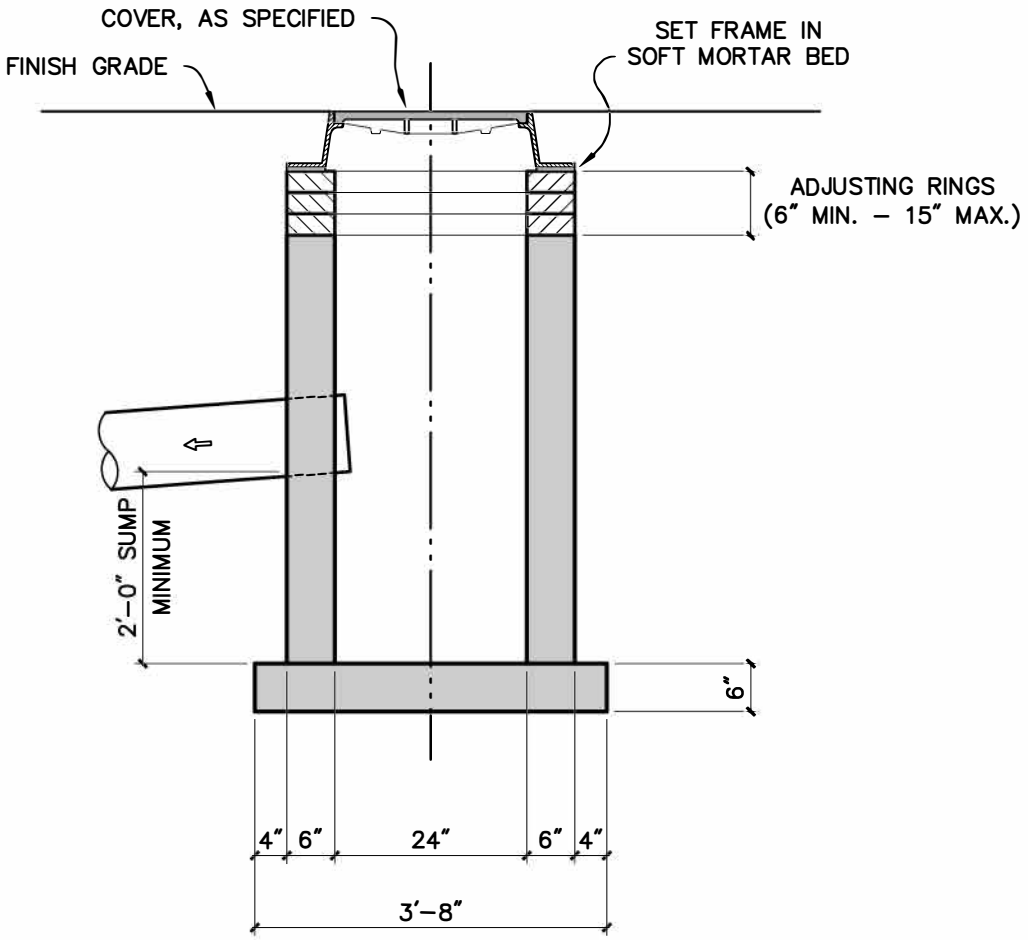
1. PRECAST CONCRETE CATCH BASIN SHALL MEET ASTM C478.
2. IF BOTTOM IS PRECAST CONCRETE, SET ON MINIMUM 4" SAND SUBBASE (CIP) OR CLASS 1A CRUSHED STONE WRAPPED IN GEOTEXTILE FABRIC.
3. STD. 4'–0" DIAMETER INLET SAME AS CATCH BASIN WITHOUT SUMP.



2' DIAMETER INLET

NOTE

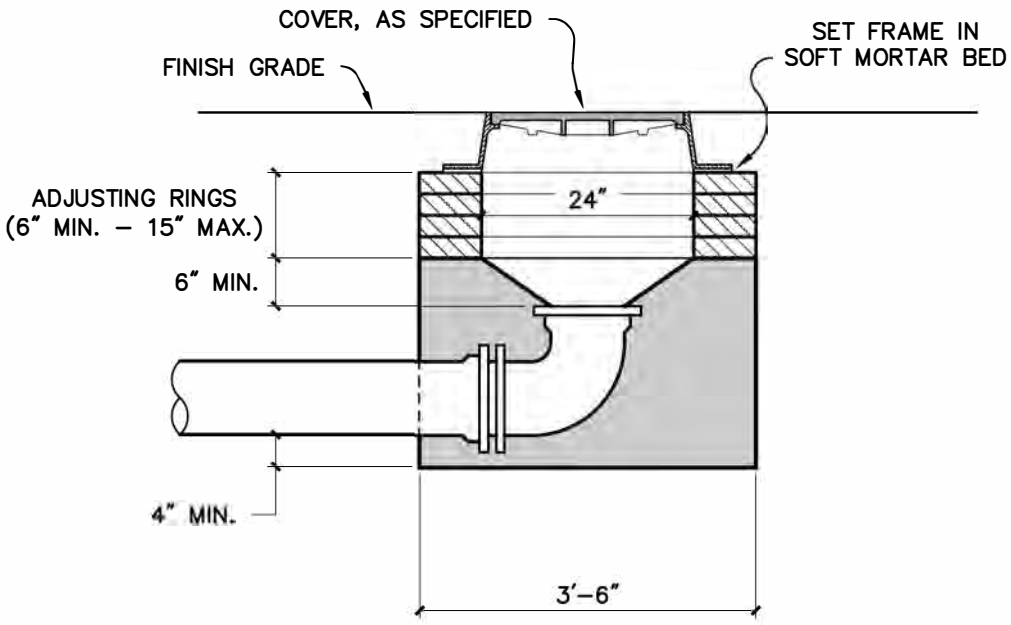
1. PRECAST CONCRETE INLET SHALL MEET ASTM C478.
2. IF BOTTOM IS PRECAST CONCRETE, SET ON MINIMUM 4" SAND SUBBASE (CIP) OR CLASS 1A CRUSHED STONE WRAPPED WITH GEOTEXTILE FABRIC.



2' DIAMETER INLET w/SUMP

NOTE

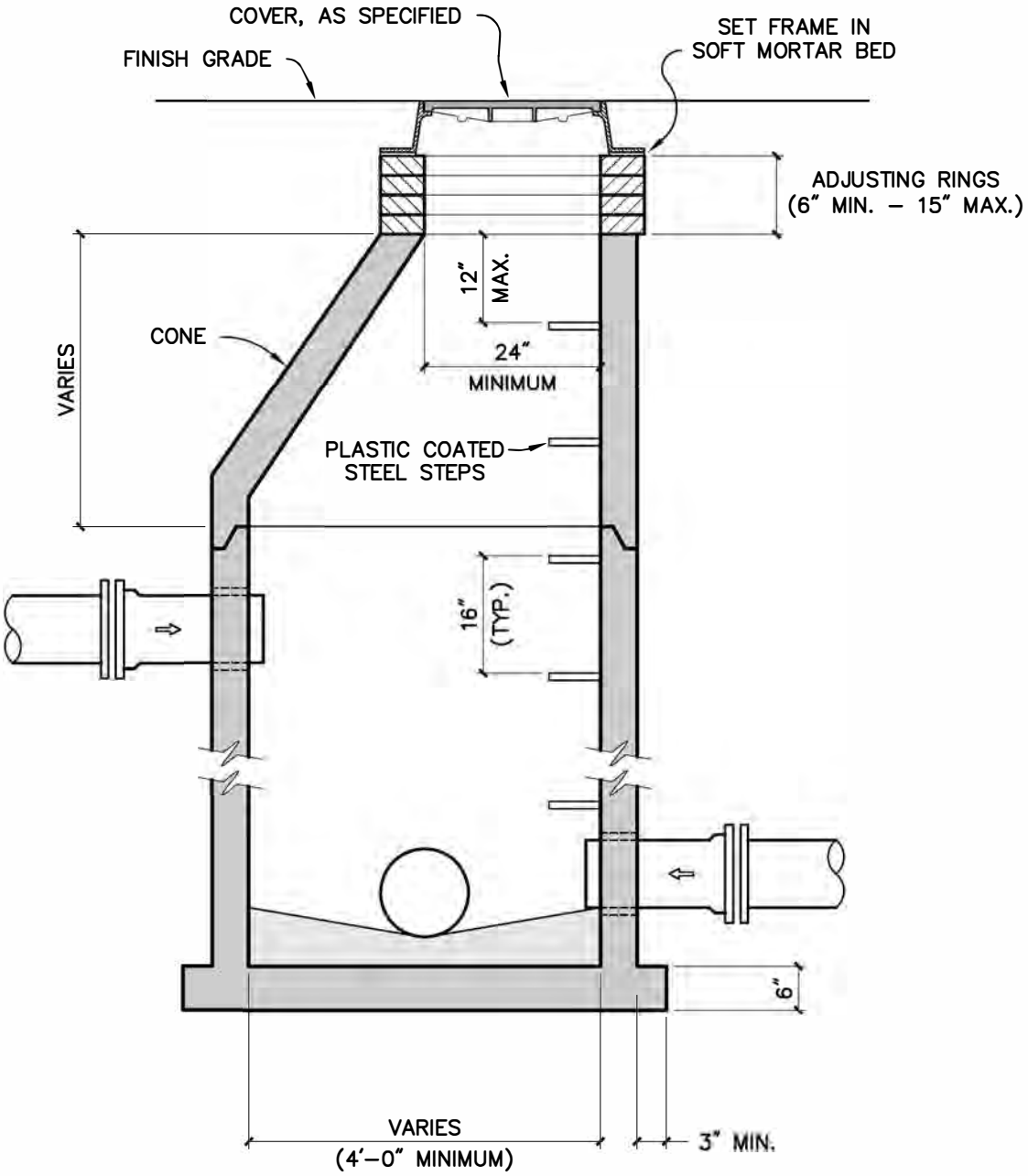
1. PRECAST CONCRETE INLET SHALL MEET ASTM C478.
2. IF BOTTOM IS PRECAST CONCRETE, SET ON MINIMUM 4" SAND SUBBASE (CIP) OR CLASS 1A CRUSHED STONE WRAPPED WITH GEOTEXTILE FABRIC.



CURB INLET

NOTE

ALSO SEE "STANDARD CATCH BASIN" PLANS FOR STD. 4'–0" DIA. INLETS



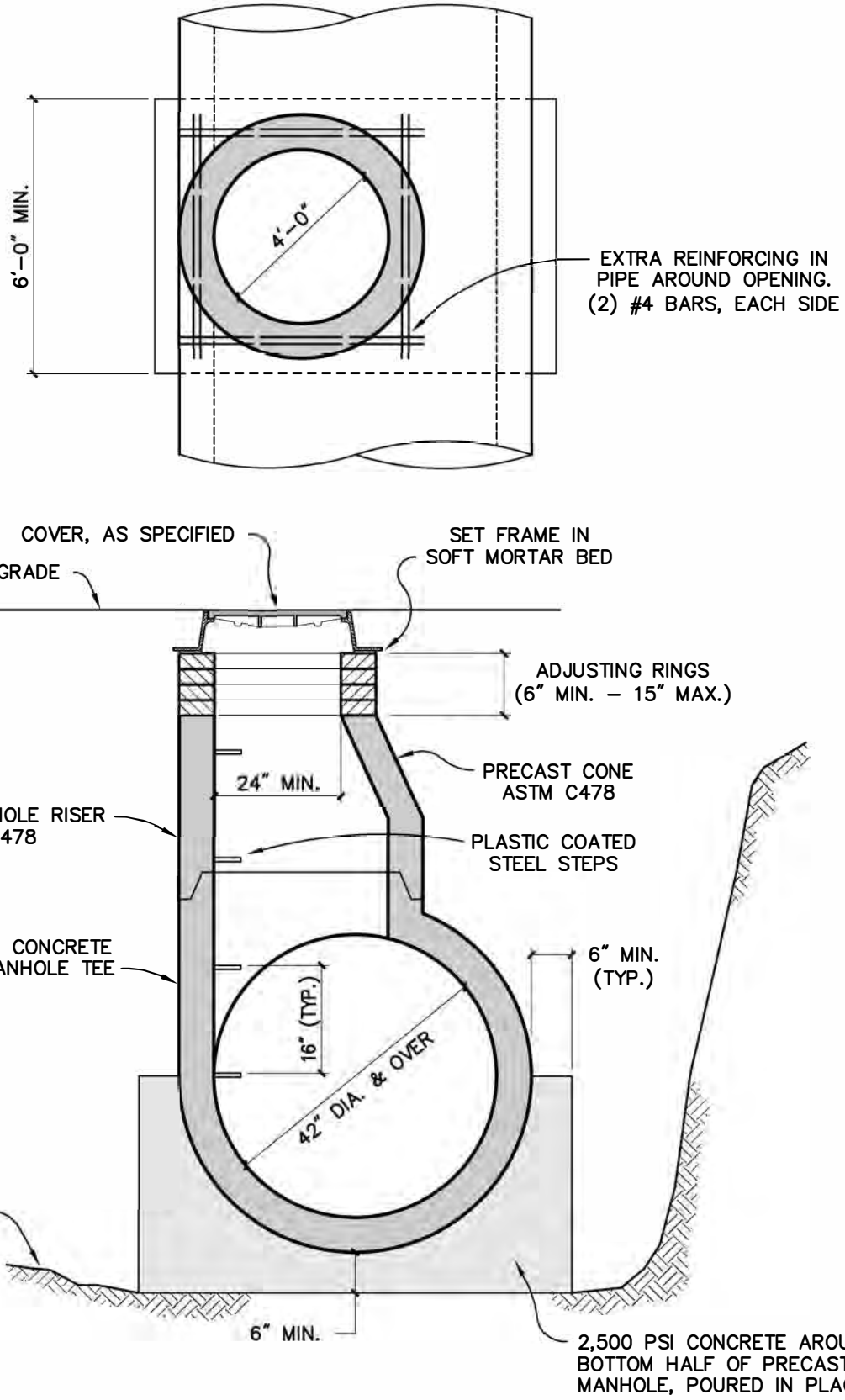
STANDARD STORM SEWER MANHOLE

(PRECAST CONCRETE)

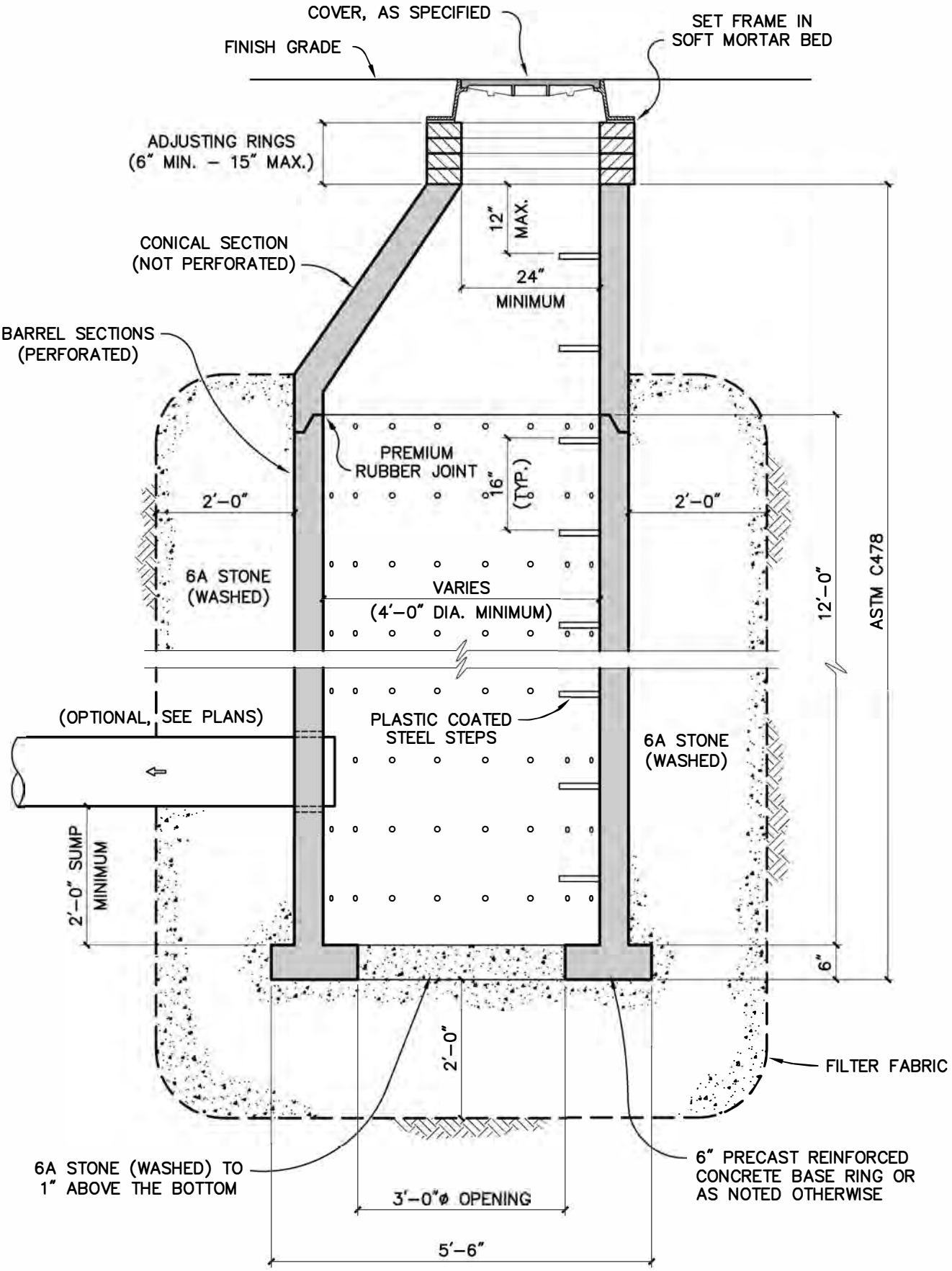
NOTES

1. PRECAST CONCRETE MANHOLE SHALL MEET ASTM C478.
2. IF BOTTOM IS PRECAST CONCRETE, SET ON MINIMUM 4" SAND SUBBASE (CIP) OR CLASS 1A CRUSHED STONE WRAPPED IN GEOTEXTILE FABRIC.
3. CONE MAY BE ROTATED TO ALIGN STEPS TO VARIOUS LOCATIONS IN MANHOLE.

Prein&Newhof
11/2021
Section 5 Storm Sewer



STANDARD STORM SEWER TEE MANHOLE



LEACHING BASIN

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SECTION 6

SPECIFICATIONS FOR SANITARY SEWER

6.01 DESCRIPTION OF WORK

The work shall consist of furnishing and installing sanitary sewer pipe of the specified size or sizes in a trench and shall include the construction of manholes, lateral connections to the abutting property and other appurtenant work. Excavating, trenching and backfilling shall be as specified in Section 2.

The work shall be performed in accordance with the specifications and drawings, the MDOT 2020 Standard Specifications for Construction and the following specifications.

6.02 MATERIALS

All materials furnished by the Contractor shall conform to the specifications which follow. Where reference specifications are used, they shall be considered as referring to the current edition or latest issue. Certified test reports for strength from the manufacturer shall be submitted to the Engineer when the pipe is delivered to the site.

6.02.01 Sewer Pipe

All sewer pipe shall be of the materials and strengths shown on the drawings or as specified.

6.02.01.01 Clay Sewer Pipe

Clay sewer pipe may be used only when specifically approved by the Owner and Engineer. If approved, clay sewer pipe shall meet the following:

Extra strength clay sewer pipe shall conform to the requirements of ASTM Designation C700.

Joints for clay sewer pipe shall be of resilient materials conforming to the requirements of ASTM Designation C425.

6.02.01.02 Concrete Sewer Pipe (12" Diameter and Larger Only)

Concrete sewer pipe may be used only when specifically approved by the Owner and Engineer. If approved, concrete sewer pipe shall meet the following:

Non-reinforced concrete pipe, fittings, and accessories shall conform to the requirements of ASTM Designation C14, Class 3.

Reinforced concrete sewer pipe shall conform to the requirements of the current specifications of the ASTM for reinforced concrete culvert, storm drain and sewer pipe, Designation C76 for the various classes specified.

Joints for concrete sewer pipe shall be premium rubber joints conforming to the requirements of ASTM Designation C443, except the infiltration and exfiltration allowance shall be as specified herein.

6.02.01.03 Polyvinyl Chloride (PVC) Solid-Wall Pipe

Polyvinyl chloride (PVC) solid-wall pipe less than 18 inches in diameter shall conform to the requirements of ASTM Designation D3034, with a standard dimension ratio of 35 (SDR-35).

Polyvinyl chloride (PVC) solid-wall pipe 18 inches in diameter and larger shall conform to the requirements of ASTM Designation F679, with a standard dimension ratio of 35 (SDR-35).

Extra strength pipe shall conform to the requirements of ASTM Designation D3034, with a standard dimension ratio of 26 (SDR-26). Extra strength pipe shall be required for installations over 18 feet deep based on the average depth of the manholes for each section of pipe.

Joints shall be flexible elastomeric sealed type joint in accordance with ASTM D3212.

6.02.01.04 Polyvinyl Chloride (PVC) Composite (Truss) Pipe

Polyvinyl Chloride (PVC) Composite (Truss) Pipe shall conform to the requirements of ASTM Designation D2680.

Joints shall be flexible elastomeric sealed type joint in accordance with ASTM D3212.

6.02.01.05 Profile Polyvinyl Chloride (PVC) Pipe

Profile polyvinyl chloride (PVC) pipe shall conform to the requirements of ASTM Designation D794. Pipe shall have a minimum pipe stiffness designation of "PS-46" or greater. If no specific pipe is specified in project specification, the Contractor shall use a closed profile pipe. All profile PVC pipe shall conform to the ASTM requirements specific for the specified pipe.

Joints shall be flexible elastomeric sealed type joint in accordance with ASTM D3212.

6.02.01.06 Ductile Iron Pipe

Ductile iron pipe shall conform to the requirements of AWWA C151 (ANSI

A21.51), and shall be Class 53, unless otherwise specified. All pipe and fittings shall have a cement mortar lining conforming to the requirements of AWWA C104 (ANSI A21.4), unless otherwise specified. Epoxy lining may be used when approved by the Engineer.

Joints shall be rubber gasket joints conforming to the requirements of AWWA C111 (ANSI A21.11). Joints on fittings shall be bolted mechanical joints.

When laying ductile iron pipe in corrosive type soils, the pipe shall be encased in a seamless polyethylene tube in accordance with AWWA C105 (ANSI A21.5) of eight (8) mills minimum thickness. The ends of adjacent sections of polyethylene tubing shall be overlapped a minimum of one (1) foot, and the joint taped or otherwise secured to prevent displacement during backfill operations.

6.02.02 Sanitary Sewer Laterals

All sewer laterals shall be extra strength pipe, and unless otherwise specified, may be of any material specified in Paragraph 6.02.01. Any specified bends or curves shall be smooth, long-radius type curves. No mitered or segmental type bends will be approved.

6.02.03 Wyes and Tees

Wyes and Tees may be cast fittings of the same material and joints as the main sewer, or may be an approved fabricated special fitting which provides a suitable connection for the lateral to the main sewer.

Details of special fittings and/or adapters for connecting laterals of a material different from the main sewer shall be approved by the Engineer before they are manufactured.

Wyes and Tees will be required as follows:

6" Wyes on main sewer of 8" or 10" diameter
6" Wyes or Tees on main sewer of 12" diameter or larger
6" Inserta-Tee, or approved equal, on main sewer of 24" diameter or larger.

6.02.04 Plugs and Stoppers

Plugs, stoppers or glued caps for plugging the ends of laterals or risers which are not extended shall make a water tight seal and shall be of such a design that they can be readily removed without damage to the pipe.

Plugs, stoppers or glued caps shall be installed at the connection point(s) to the existing sewer system to protect existing sewer lines from contamination. The plugs, stoppers or caps shall not be removed until the new system is approved by the Owner.

6.02.05 Cement Mortar

Mortar shall consist of one part Air Entraining Portland Cement, and two parts masonry sand. These proportions shall be measured by volume.

The sand and cement shall be mixed dry in a clean tight box until a mixture of uniform color is produced, after which water shall be added until the required consistency is obtained. Mortar shall be mixed only in such quantities as needed for immediate use. The retempering of mortar will not be permitted.

6.02.05.01 Cement

Air Entraining Portland Cement shall conform to the requirements for Type 1A of the MDOT 2020 Standard Specifications for Construction for Air Entraining Portland Cement, ASTM Designation C150.

6.02.05.02 Masonry Sand

Masonry Sand shall conform to the requirements of "Natural Sand, 2MS" of the MDOT 2020 Standard Specifications for Construction.

6.02.05.03 Water

Water for mixing mortar shall be obtained from the public water supply unless otherwise approved by the Engineer.

6.02.06 Concrete

Concrete for pipe encasement, special pipe embedment, manhole bases and similar items shall meet the requirements of the MDOT 2020 Standard Specifications for Construction for Grade 3000 concrete. Grade 3000 concrete shall have the strength of 3,000 psi at 28 days.

6.02.07 Manhole Materials

6.02.07.01 Adjusting Rings

Precast grade adjusting rings shall conform to the requirements of ASTM Designation C478.

6.02.07.02 Precast Units

Unless otherwise specified, all manholes shall be precast and water tight.

Precast reinforced concrete manhole risers and precast reinforced concrete manhole conical top sections shall conform to the requirements of ASTM C478, Precast Reinforced Concrete Manhole Sections. Bituminous waterproofing shall be applied to outer surface of manhole at a rate of one gallon per 100 square feet. Manholes shall be free of holidays and open pinholes.

Joints for precast sections shall be premium rubber, butyl rubber composition seals, "RAM-NEK", or approved equal.

6.02.07.03 Castings

Castings shall meet the requirements specified in the MDOT 2020 Standard Specifications for Construction Section 908. Manhole covers and rings and similar combinations of castings shall be machined to provide an even bearing.

Unless otherwise specified, manhole castings shall be provided with 24 inch openings and shall be EJ No. 1040 with Type A solid cover, or approved equal.

Where indicated on the plans, water-tight manhole covers shall be EJ No. 1040 WT, with Type A solid cover, or approved equal.

6.02.07.04 External Casting and Adjusting Ring Seals

The casting frame, adjusting rings and top section of all manholes shall be wrapped with a watertight seal joint encapsulation system with rubber backing to minimize infiltration into the manhole. Material shall be Infi-Shield External Uni-band Seal by Sealing Systems, Wrapid Seal by CANUSA-CPS, or approved equal. Installation shall follow manufacturer's recommendations.

6.02.07.05 Steel Reinforcement

Steel Reinforcement shall conform to the requirements for steel reinforcement of Section 905 of the MDOT 2020 Standard Specifications for Construction.

6.02.07.06 Flexible Manhole Connectors (Rubber Boots)

Flexible manhole connectors (also called rubber boots) shall be "Kor-N-Seal" by National Pollution Control Systems, Inc., "P.S.X." or "Press Wedge II" by Press Seal Gasket Corporation, "Lock Joint Flexible Manhole Sleeve" by Inter Pace Corporation, "A-LOK," "Z-LOK," or "QUIK-LOK" by A-LOK Products, Inc. or approved equal. Flexible manhole connectors shall conform to the requirements of ASTM Designation C923, Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

6.02.07.07 Manhole Steps

Unless otherwise specified, manhole steps shall be plastic coated steel steps conforming to the requirements of ASTM Designation C478, or approved equal, spaced at sixteen inches (16") on center.

6.02.07.08 Manholes with Corrosive Conditions

When shown on the drawings, or included in the proposal items, manholes that

are anticipated to have corrosive conditions due to septicity, forcemain connection or other causes shall be provided with corrosion protection on the interior of the manhole.

Corrosion protection may be provided via a polymer concrete manhole, a bond welded PVC cast in place liner, or an epoxy liner as approved by the Engineer.

6.03 INSPECTION OF MATERIALS BY CONTRACTOR

It shall be the responsibility of the Contractor to inspect all materials for cracks, flaws or other defects before they are incorporated into the work. Any materials found to be defective or damaged shall be promptly removed from the job site by the Contractor.

6.04 LAYING PIPE

6.04.01 Alignment and Grade

6.04.01.01 Laser Alignment

The Contractor shall use the laser beam method of maintaining line and grade for sewer construction, unless otherwise approved by the Engineer. The Contractor shall submit evidence to the Engineer that a qualified operator will operate the laser beam equipment during the course of construction.

The Engineer shall place line and grade stakes at each manhole, or more often, as determined by the Engineer. The Contractor shall check the line and grade at every point at which a stake has been placed.

6.04.02 Handling

Pipe shall be protected during unloading and handling against impacts, shocks and free fall. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

6.04.03 Direction of Laying

Excavation of trenches and laying of pipe shall begin at the outlet for the sewer and proceed upgrade with the individual pipe being laid with the spigot end downstream.

6.04.04 Placing

The pipe shall be placed on the prepared sub-grade and held firmly in place during subsequent pipe jointing and embedment operations. Successive pipes shall be carefully positioned so that when laid, they form a sewer with a uniform invert true to line and grade.

Sufficient pressure shall be applied by an approved method to each pipe as it is

laid to ensure that the spigot is completely home in the bell. Care shall be exercised to prevent joints from opening as successive lengths of pipe are placed. The Contractor shall take the necessary precautions when using a trench box to prevent joint separation when the box is pulled ahead.

All plastic/flexible pipe shall be installed in accordance with ASTM D2321. Rigid pipe shall be installed in accordance with ASTM C12 (vitrified clay pipe) and ASTM C1479 (precast concrete pipe), if approved by the Owner.

6.04.05 Cleaning Sewer

The interior of the sewer shall be cleaned of all jointing material, dirt and debris as the work progresses.

In small sewers where cleaning after laying may be difficult, a swab or drag may be required in the pipeline to satisfactorily complete this work. Where possible, a plug shall be installed on the downstream end of the sewer to prevent any sand and debris from entering the existing sewer.

6.05 PIPE JOINTS

Pipe joints shall be made in strict accordance with the pipe manufacturer's recommendations unless otherwise specified herein. All lubricants, gaskets and other materials required to make the joints shall be supplied or recommended by the pipe manufacturer, and approved by the Engineer.

Pipe layers shall be fully qualified and experienced in the work being performed and shall check each joint after it is completed to see that no part of the joint material is left on the inside of the pipe and that the joint is properly made.

6.06 LOCATION OF WYES AND TEES

The approximate locations of wyes or tees are shown on the drawings. These locations may be adjusted where necessary to best serve the various properties. Exact locations shall be determined by the Engineer before the wyes or tees are installed.

The Contractor shall keep an accurate record of measurements from the nearest downstream manhole to each wye or tee which is installed, the length of each lateral, the depth at the end of each lateral and the distance to the down stream manhole parallel to the sewer at the end of each lateral. These measurements shall be recorded on the record plan to be furnished by the Contractor to the Engineer and Owner.

6.07 SANITARY SEWER LATERALS

6.07.01 General

Installation of sanitary sewer laterals shall meet all requirements specified for

sanitary sewers. All laterals shall be inspected by the Engineer before the trench is backfilled.

6.07.02 Length

All sanitary sewer laterals shall be laid at right angles to the sanitary sewer mainline unless otherwise shown on the drawings, and shall extend to a point one foot outside the street right of way (property line) unless otherwise directed. No payment will be made for pipe laid beyond this point unless specifically ordered by the Engineer.

The Contractor shall measure and record on his record drawing the horizontal length of the lateral from the main line sewer to the end of the lateral and provide this information to the Engineer.

6.07.03 Grade

It is intended that the ends of laterals at property lines will be deep enough to service the lowest floor of all existing buildings by gravity flow.

The minimum grade on the lateral shall be 2 percent (1/4 in/ft.). Where minimum depths as specified herein cannot be obtained and when approved by the Engineer, minimum grades may be reduced to 1 percent (1/8 in/ft.).

Where the elevation of the end of the lateral to serve an existing structure is not shown on the drawings it shall be set at 3 feet below basement grade for standard houses (11 feet below first floor) or 4 feet below basement grade for houses with walkout basements (12 feet below first floor) where the set-back is 50 feet or less. When the house is set back further than 50 feet it may be set at 2 feet below the basement elevation for standard houses (3 feet for walkouts) plus an additional depth of 2 percent multiplied by the set-back distance to the structure.

The minimum depth of the end of the lateral at the property line in all cases shall be a minimum 9'-0" below centerline of the street. (See lateral and property line riser detail in these specifications.)

6.07.04 Risers

Where the sanitary sewer is more than twelve feet deep, a main line riser shall be constructed in accordance with the standard details or as shown on the drawings. Backfill shall be carefully placed and compacted around the riser in an approved manner which will not damage the sewer or riser.

Property line risers shall be constructed at the end of the lateral (at a point approximately five (5) feet from the right-of-way line unless otherwise specified).

The property line riser shall consist of a 6" sewer lateral pipe extended upward to a minimum of one (1) foot above the normal groundwater table, or to a depth of not greater than four (4) feet below grade at the end, whichever is the closest to

finished grade. In all cases the lateral shall have a minimum of two (2) feet of cover.

6.07.05 Markers and Measurements

After installation of the service lateral, but prior to backfilling, the Contractor shall provide and install a 2" x 2" wood marker for each service. The wood markers shall be set vertically from the end of the lateral to twelve (12) inches above finish surface elevations. Also, a 1/2" diameter by 3' long metal stake shall be placed vertically and adjacent to the wood marker with 6" cover. The Contractor shall assist the Construction Observer in locating the end of each lateral, and in recording the location by measuring to the nearest downstream manhole.

After the record drawing locations have been recorded and checked by the Construction Observer, the Contractor shall cut off the markers as follows: in improved areas, the markers shall be cut off two inches below grade; in undeveloped areas, the markers shall be cut off six inches above grade.

6.08 MANHOLE CONSTRUCTION

Manholes shall be constructed in accordance with the standard details and as specified herein. Manholes shall be water tight.

Unless specified otherwise, all manholes shall be precast.

Precast bases shall be installed on sand or gravel subbase in such a way as to provide a uniform bearing under the manhole base.

Precast manholes with integral bottom and channel may be used; however, any changes to the structure due to minor field adjustments in alignment and grade required to meet construction conditions, shall be made by the Contractor at no additional cost to the Owner.

Benches shall be constructed from the invert to the crown on the pipe for the entire length of the manhole or junction point.

Stubs shall be provided in manholes for future connections as shown on the drawings or as directed by the Engineer. All such stubs shall be sealed with standard watertight, removable plugs.

All openings in manholes for the purpose of receiving pipes (including openings for future pipes) shall be fitted with a flexible type connector. Flexible connectors shall be factory installed. Openings for future connections shall be sealed by an approved prefabricated cap or plug.

Precast concrete adjusting rings shall be used to bring existing and new manhole structure covers within the proposed pavement to grade. After the cover is

brought to grade, the entire hole created by excavating to raise the casting shall be filled in three-inch (3") lifts with Hot Mix Asphalt Mixture 3C or 13A to the top of the leveling course and air tamped to achieve proper compaction. Special care shall be taken to prevent debris from entering sewers.

6.09 CUT-INS

When cutting into an existing manhole, the opening shall be no larger than is necessary to admit the new sewer. The opening shall be made by a concrete drilling or coring machine and shall have a mechanically compressed flexible joint connection installed. All broken or surplus material falling inside the structure shall be removed.

Flow channels and/or drop connections shall be constructed as specified or as directed to accommodate the sewer being cut-in.

Unless otherwise specified, cut-ins shall be considered part of the major items of work, and no specific payment will be made therefor.

6.10 ACCEPTANCE TESTS

6.10.01 Alignment and Grade

Each section of sewer may be checked by the Engineer for alignment and grade using lights and mirrors, television inspection, or other similar means. The Contractor shall assist the Engineer in the performance of these tests when necessary.

If a section of sewer is determined by the Engineer not to be acceptable for alignment or grade, the Contractor shall relay the sewer at no additional cost to the Owner.

6.10.02 Leakage Tests

The completed sewer shall be free from leaks either by infiltration or exfiltration. Manholes will be visually inspected for leakage. No more than 1,000 feet of main sewer will be considered for partial payment until it has been satisfactorily tested and approved.

The Contractor shall provide all necessary labor, equipment and supervision to perform infiltration, exfiltration and air tests in accordance with the requirements of the Engineer. All sewers shall be subjected to an air test unless otherwise specified below.

All sewers which are submerged by ground water to an average depth of greater than seven (7) feet above the crown of the sewer at the time of the test shall be subjected to an infiltration test.

The air test shall be performed on each section of pipe between manholes after

laterals are installed. Testing shall conform to ASTM F1417 for plastic flexible pipe, ASTM C828 for clay pipe (if approved) and ASTM C924 for reinforced concrete pipe. The section of pipe being tested shall be sealed at each manhole using inflatable plugs or other approved devices. All plugs shall be adequately braced.

Where the expected water table level, as determined by the soil borings, is above the sewer elevation, the pressure testing limits for dry trench conditions shall be as follows:

1. Where the expected water table level is 0' to 7' above the pipe, the test pressure limits will be 3.5 to 2.5 psig.

2. Where the expected water table level is over 7' above the pipe, the test pressure limits will be 4.5 to 3.5 psig.

In a wet trench condition where the water table has risen above the pipe to a depth of less than 7' above the crown of the pipe prior to testing, the air testing limits shall be determined by adding to the original 3.5 psig. an additional 0.433 psig. for each foot the water table is above the crown of the pipe, or as determined in the dry trench condition, whichever is greater.

The air pressure in the section under test shall be raised to an initial pressure of 0.5 psig. above the beginning test pressure and allowed to stabilize for a minimum of five (5) minutes. Air shall be added during this stabilization period as required to maintain the pressure at or above the beginning test pressure.

The rate of air loss shall be determined by measuring the time interval required for the internal pressure to decrease 1.0 psig. within the limits previously specified.

Minimum time interval for satisfactory test shall be in accordance with Table 1 and Table 2 following this section.

In the event the Engineer determines that the results of the air test are inconclusive because of visible infiltration, unsatisfactory or incomplete records, or improper application of testing methods or equipment, or other similar reasons, the Engineer may require either an exfiltration test or an infiltration test for the section or sections of sewer involved.

The allowable leakage as measured by either an infiltration test or an exfiltration test shall not exceed 50 gallons per day per inch of diameter per mile of sewer.

Sewers shall be tested for exfiltration by isolating a section or sections of the sewers between manholes by means of an approved temporary type of water-tight bulkhead. The isolated section of sewer shall then be filled with water to a level which is two and one-half (2-1/2) feet above the existing water-table but not less than two and one-half (2-1/2) feet above the crown of the sewer pipe at the high

end of the isolated section under the test. The length of the section shall be such that, where possible, the water level at its lower end will not be more than five (5) feet above the crown of the pipe except as may be required by a high water table.

The length of time and the exfiltration test period shall be at the discretion of the Engineer. Determination of the amount of exfiltration shall be made by measurement of the loss of volume of water in the manholes. The amount of exfiltration over a 24 hour period will then be calculated from the measured loss of volume and time period.

On any section of sewer that the Engineer shall deem impractical to test by means of the exfiltration test specified above, as may be the case when local connections are involved, a suitable infiltration test will be required.

6.10.03 Pipe Deflection Tests (Flexible Pipe Only)

Flexible pipe is any pipe having a pipe stiffness of 115 psi. or less as defined under the requirements of ASTM Designation D2412. Truss pipe will not require a deflection test if it has less than twelve feet (12') of cover.

The completed installation of flexible pipe shall at no point have out-of-round deflections in the main sewer pipe greater than five percent (5%) of the pipe's actual original inside diameter. Go/no go gauging tests, using an approved pointed mandrel with nine (9) points, shall be performed by the Contractor in the presence of the Engineer, or his authorized representative after the trench is backfilled, and before the surface restoration is begun. Pipe with deflections greater than five percent (5%) shall be relaid by the Contractor at no additional expense to the Owner. Use of mechanical devices or equipment to complete the go/no go tests and vibratory rerounding of failed sections are prohibited. A minimum of thirty (30) days shall elapse between installation and backfilling and deflection testing.

6.10.04 Televising

After the pipe deflection test, placement of base course (when the pipe is proposed under pavement), and pipe cleaning (when the sewer has been live prior to televising), the Contractor shall conduct a continuous digital video recording inspection of all sanitary sewers. The inspection and documentation shall meet the requirements of the National Association of Sewer Service Companies (NASSCO) specification for television inspection of sewers. Closed-circuit television (CCTV) recording shall be conducted in compliance with the North American Pipeline Assessment and Certification Program (PACP) standards for sewer defect identification and assessment. Work shall be performed by a PACP-certified operator and delivered on professional quality recording media with audio input that is compatible with the Engineer’s and Owner’s equipment for viewing. The televising software shall be PACP-certified by NASSCO and shall be capable of both exporting to and importing from the standard PACP database.

If the television inspection of an entire section (manhole to manhole) cannot be successfully performed from one manhole, a reverse setup shall be performed per PACP requirements as a second survey.

The Contractor shall provide a written report, two copies of the recording on USB Thumb Drive, and a digital copy of the exported PACP database. The recording shall show the name of the project, the purpose of inspection, the date and approximate time of recording, the name of the street, the manhole numbers of each end of each run (the "from" and "to" manholes) and stationing between manholes. The recording shall clearly show the pipe interior, joints, alignment, and wye locations and stations, and shall be reviewed by the Engineer for evidence of compliance with the Contract Documents for workmanship and materials. The written report shall contain a log for each recording to provide a written record of the information provided on the recording, and shall show the name of the project and all other pertinent data.

6.11 MEASUREMENT AND PAYMENT

6.11.01 General

All proposed construction shall be measured for payment by the Engineer in accordance with the items listed in the Proposal.

The unit price bid for each Proposal item shall be payment in full for completing the work, ready for use as specified.

6.11.02 Sanitary Sewers

Measurement of the length of the sewer shall be in lineal feet along the centerline of the sewer from center of manhole to center of manhole.

Where depth classifications are provided, the depth of the sewer connecting two adjacent structures shall be considered as being the average of the depth from earth grade to the sewer invert at these structures.

6.11.03 Manholes

Manholes shall be paid for in accordance with the units established in the Proposal. When no Proposal item is provided for castings, the castings and their installation shall be considered part of the major items of work.

When corrosion protection is needed for existing manholes, this shall be paid for separately in accordance with the units established in the Proposal. When called for on the drawings or in the project specifications for corrosion protection in new manholes, this shall be paid for separately in accordance with the units established in the Proposal; if no Proposal item is provided, corrosion protection shall be considered included in the Proposal item for manholes.

6.11.04 Wyes or Tees

When a specific item is provided in the Proposal for Wyes or Tees the unit price bid shall be the additional cost of furnishing and placing the wye or tee over and above the cost of furnishing and laying the sewer pipe.

When no Proposal item is provided, the wyes or tees and their installation shall be considered part of the major items of work.

6.11.05 Sanitary Sewer Laterals

The length of sewer laterals shall be measured horizontally from the center of the main sewer to the end of the lateral as specified.

6.11.06 Cut-Ins

Cut-ins shall be considered part of the major items of work and no specific payment will be made therefor.

6.11.07 Stubs

Stubs shall be considered part of the major items of work and no specific payment will be made therefor.

6.11.08 Risers

The length of main line risers shall be measured vertically from the top of the main sewer to the end of the riser. The length of property line risers shall be measured vertically from the top of the lateral at the lower bend for the riser to the end of the riser. When no Proposal item is provided, the risers and their installation shall be considered part of the major items of work.

TABLE 1 – PVC and DI Pipe

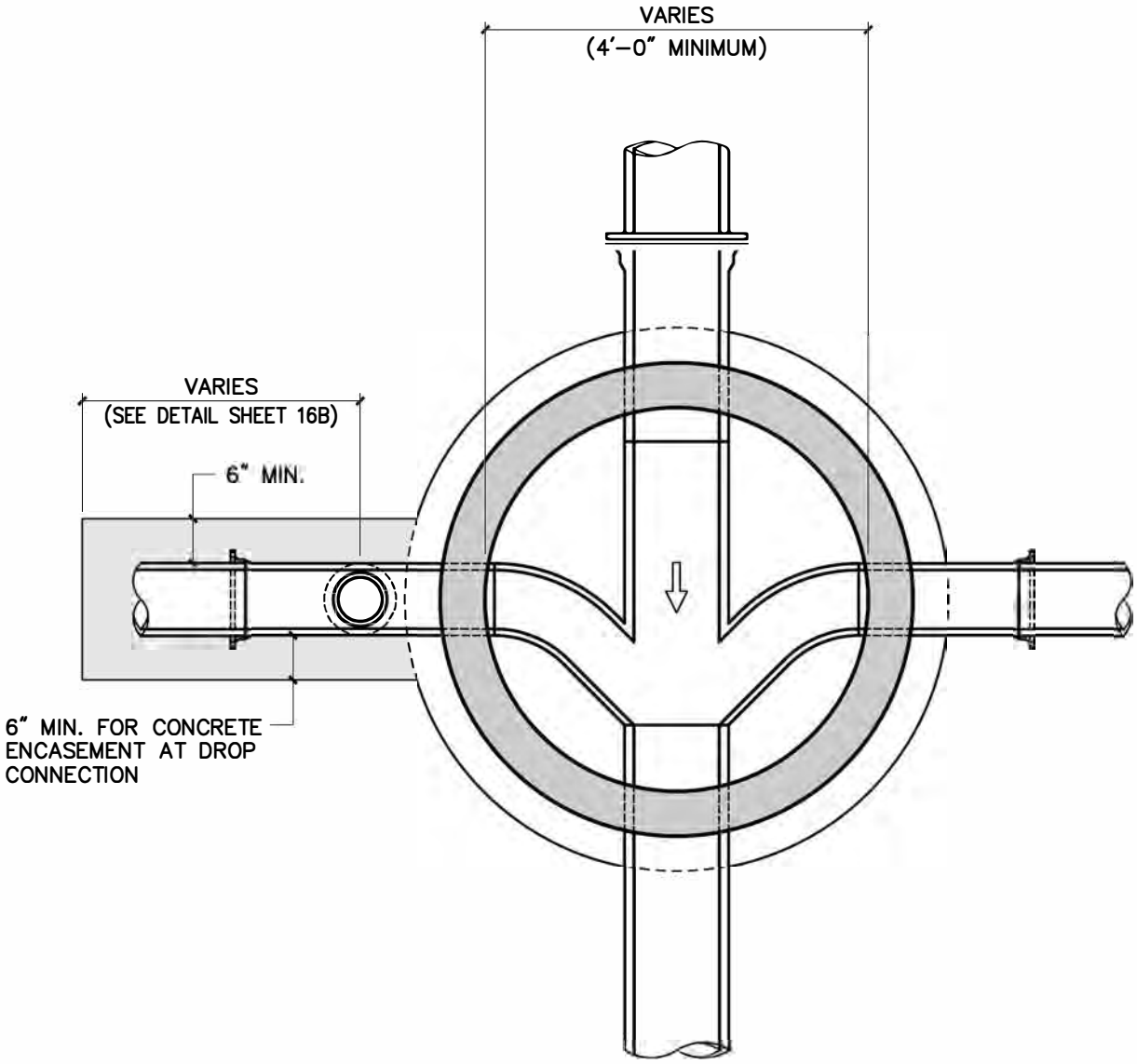
Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

TABLE 2 – VCP and Concrete Pipe

Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Length, s	Specification Time for Length (L) Shown, min:s							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	0.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

Note: Table to be used when testing one diameter only.
When testing two sizes of pipe simultaneously, time shall be computed by the ratio of lengths involved.

$$\text{Time} = \frac{\text{Length 1} \times \text{Time1} + \text{Length 2} \times \text{Time 2}}{\text{Length 1} + \text{Length 2}}$$



PLAN VIEW

STANDARD SANITARY SEWER MANHOLE

(PRECAST CONCRETE)

NOTES

1. IF BOTTOM IS PRECAST CONCRETE, SET ON MINIMUM 4" SAND SUBBASE (CIP) OR CLASS 1A CRUSHED STONE WRAPPED WITH GEOTEXTILE FABRIC..
2. CONE MAY BE ROTATED TO ALIGN STEPS TO VARIOUS LOCATIONS IN MANHOLE.
3. FLOW CHANNEL WALL HEIGHT SHALL BE EQUAL TO CROWN OF PIPE.

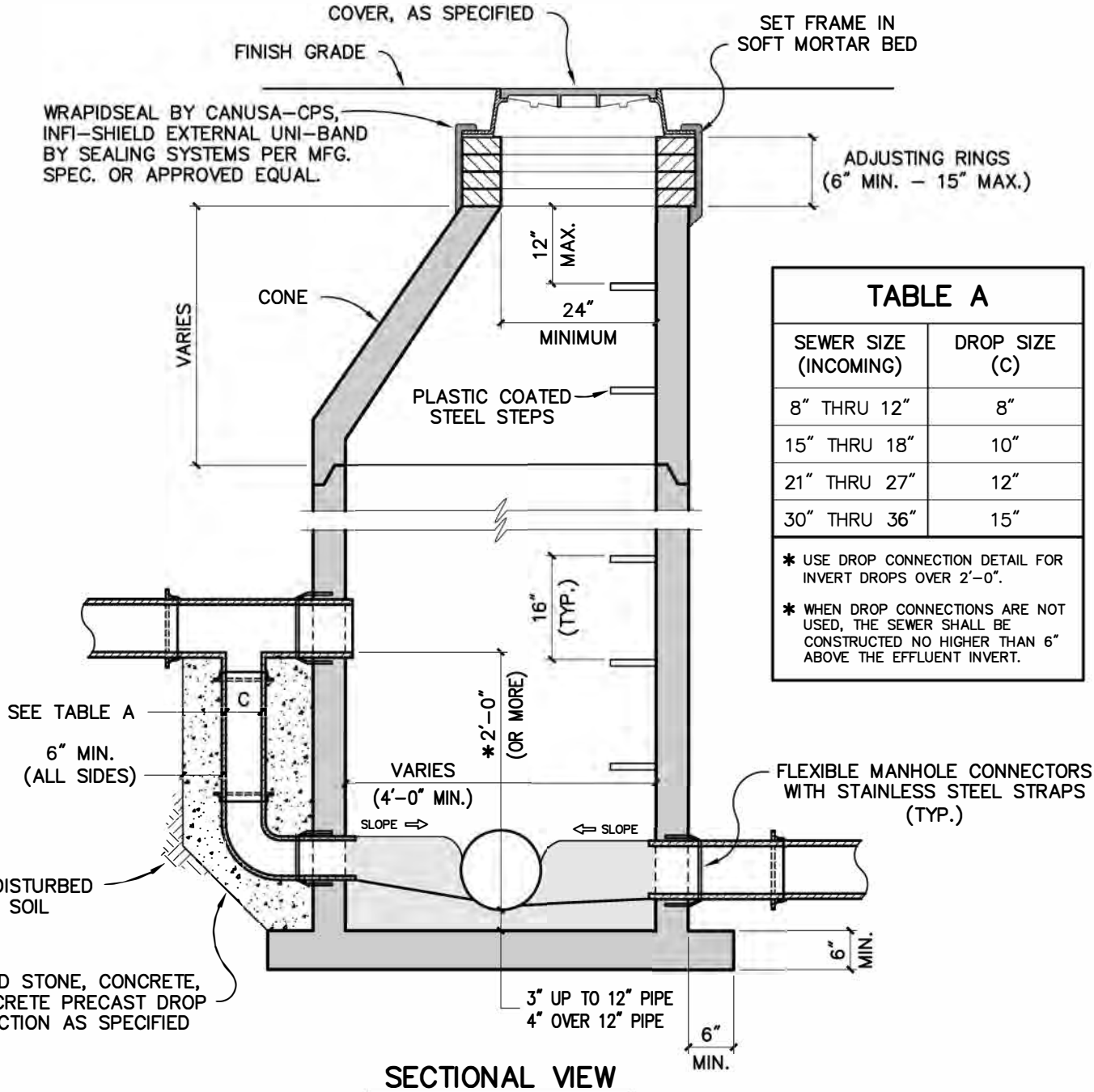


TABLE A	
SEWER SIZE (INCOMING)	DROP SIZE (C)
8" THRU 12"	8"
15" THRU 18"	10"
21" THRU 27"	12"
30" THRU 36"	15"

* USE DROP CONNECTION DETAIL FOR INVERT DROPS OVER 2'-0".

* WHEN DROP CONNECTIONS ARE NOT USED, THE SEWER SHALL BE CONSTRUCTED NO HIGHER THAN 6" ABOVE THE EFFLUENT INVERT.

SECTIONAL VIEW

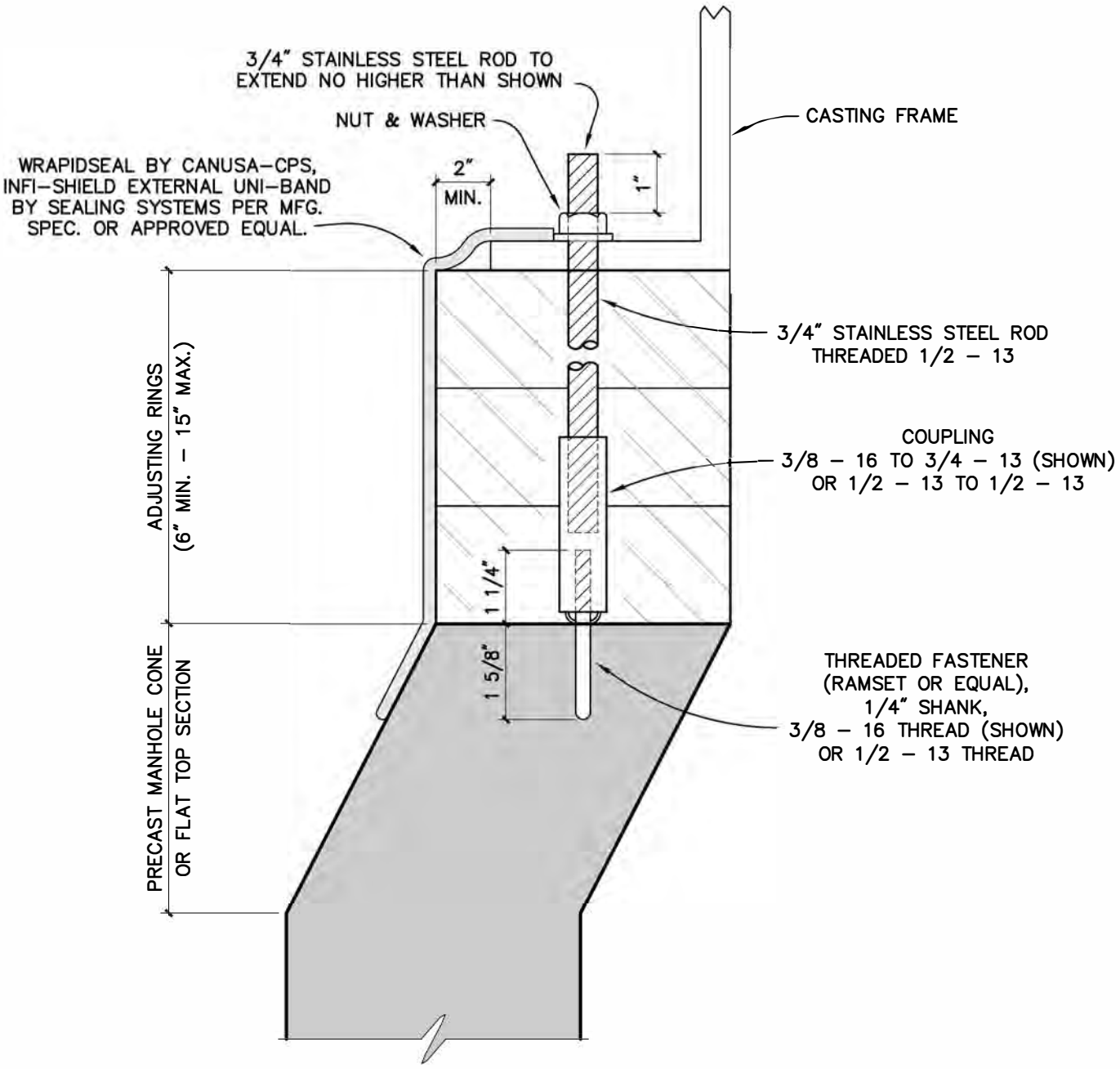
STANDARD SANITARY SEWER MANHOLE

(PRECAST CONCRETE)

NOTES

1. PRECAST CONCRETE MANHOLE SHALL MEET ASTM C478.
2. IF BOTTOM IS PRECAST CONCRETE, SET ON MINIMUM 4" SAND SUBBASE (CIP) OR CLASS 1A CRUSHED STONE WRAPPED IN GEOTEXTILE FABRIC.
3. CONE MAY BE ROTATED TO ALIGN STEPS TO VARIOUS LOCATIONS IN MANHOLE.
4. FLOW CHANNEL WALL HEIGHT SHALL BE EQUAL TO CROWN OF PIPE.

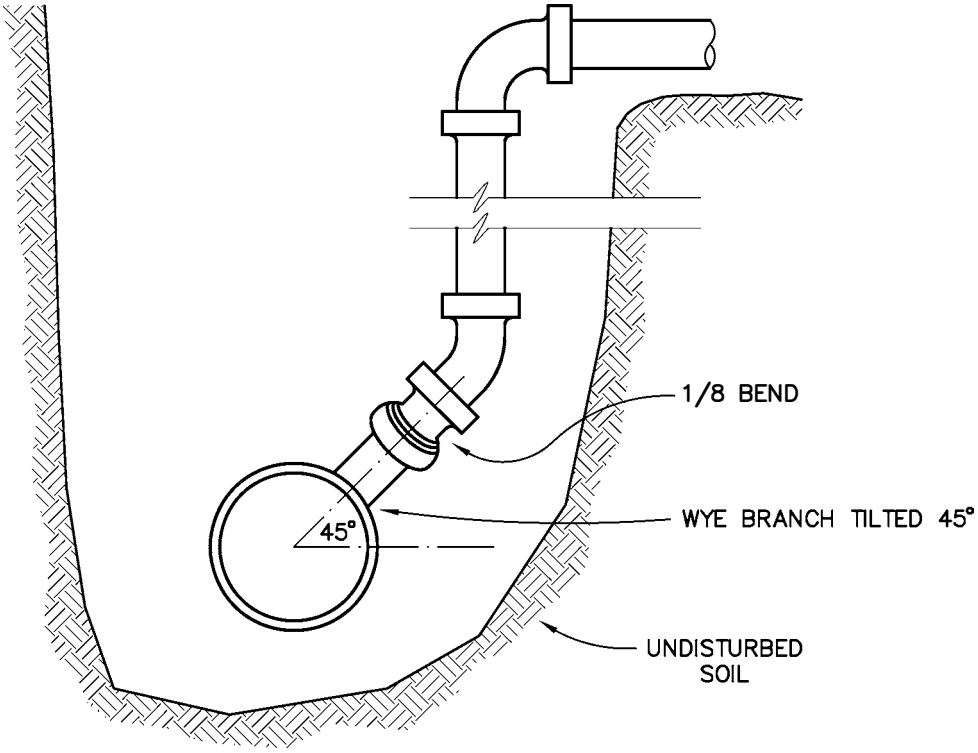
Prein&Newhof
11/2021
Section 6 Sanitary



ANCHOR DETAIL

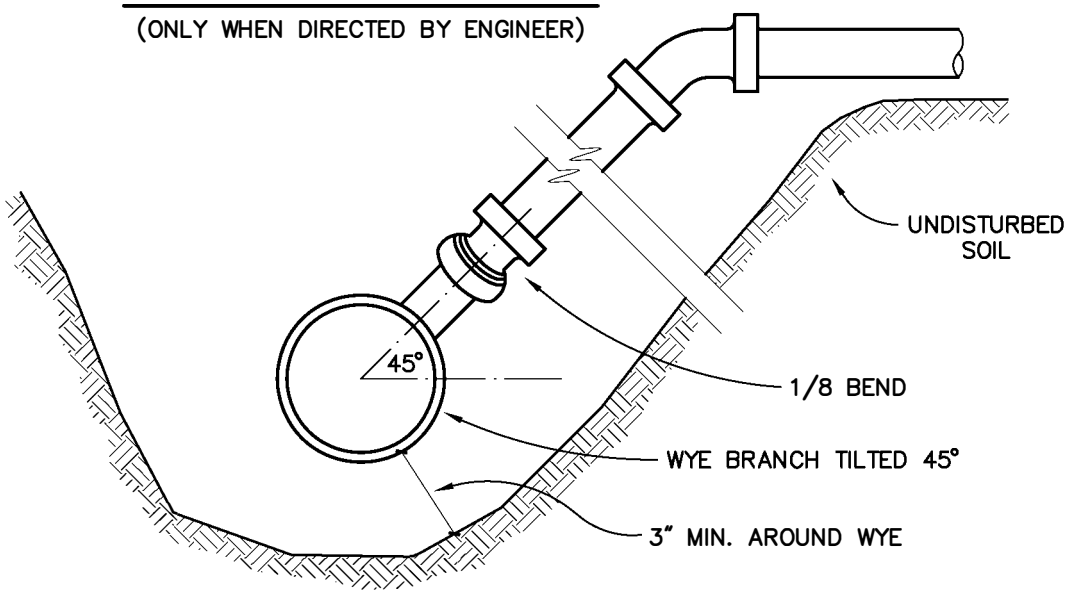
NOTE

FOR ALL PRESSURE TIGHT OR WATERTIGHT COVERS,
FOUR (4) ANCHORS PER COVER



VERTICAL TRENCH

(ONLY WHEN DIRECTED BY ENGINEER)



SLOPING TRENCH

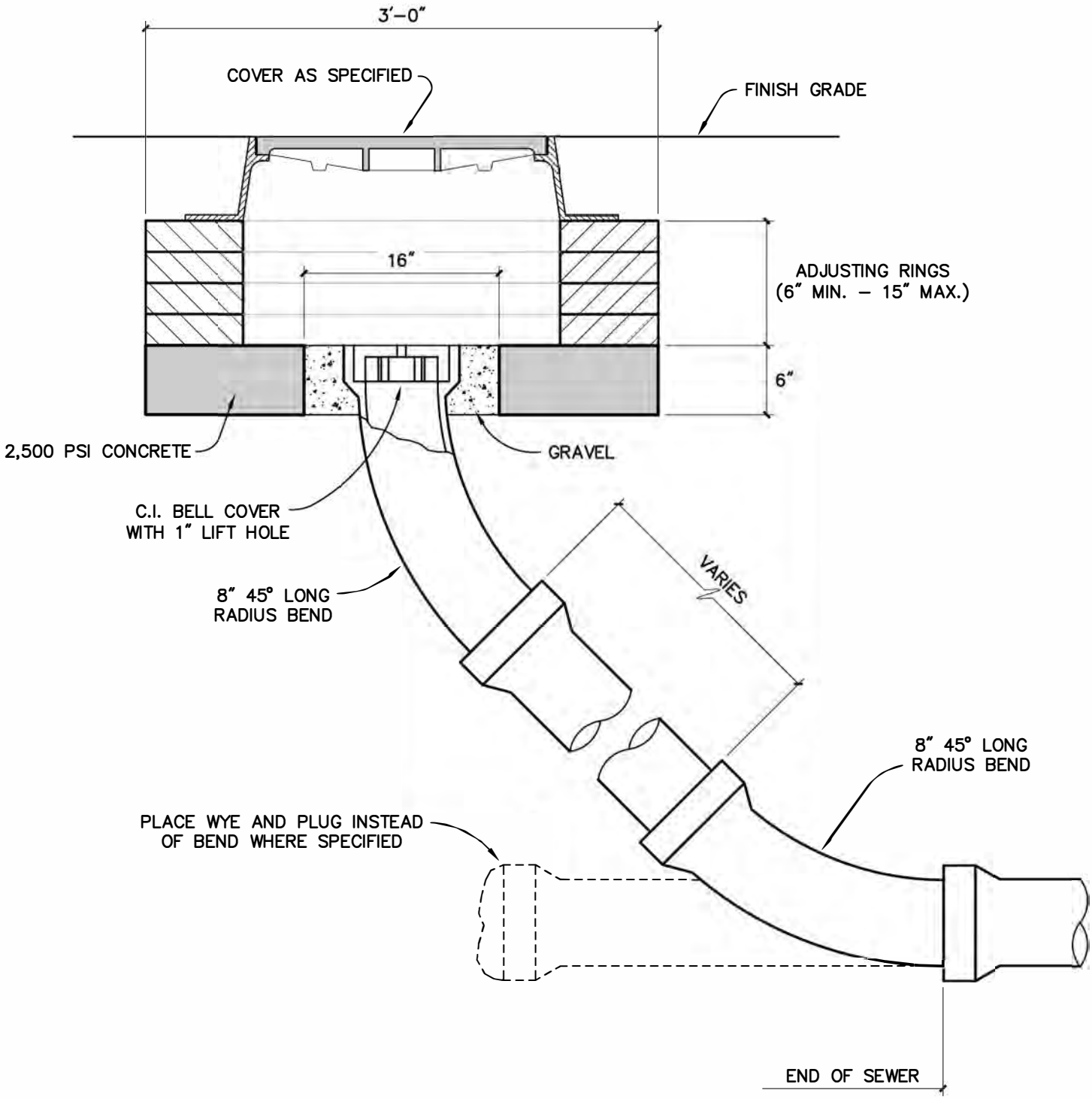
(STANDARD)

STANDARD RISER DETAILS

(SEWERS OVER 12 FEET DEEP)

NOTE

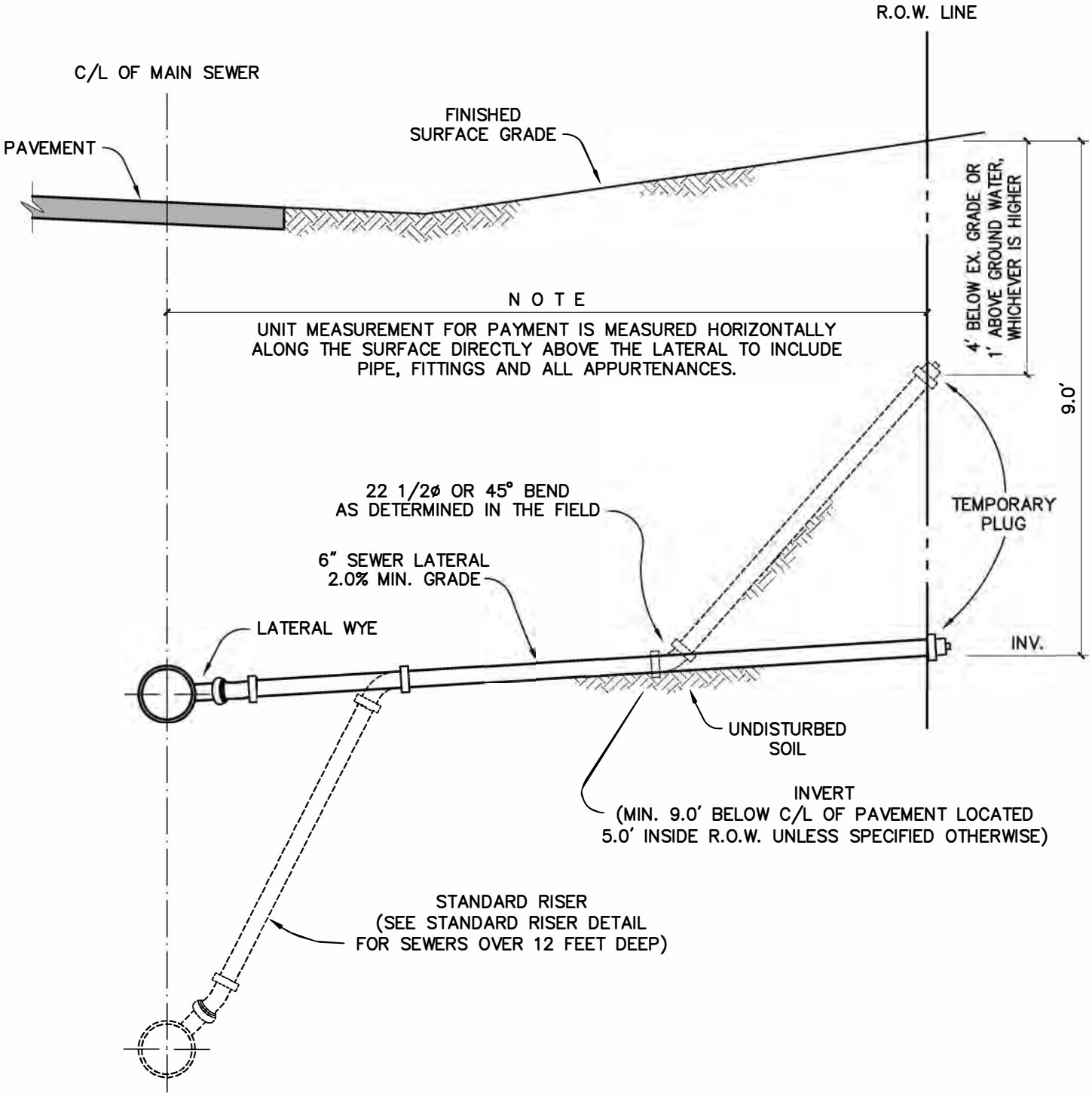
SEE PLANS OR SPECS FOR SIZE AND DEPTH OF LATERAL



SEWER CLEANOUT

NOTES

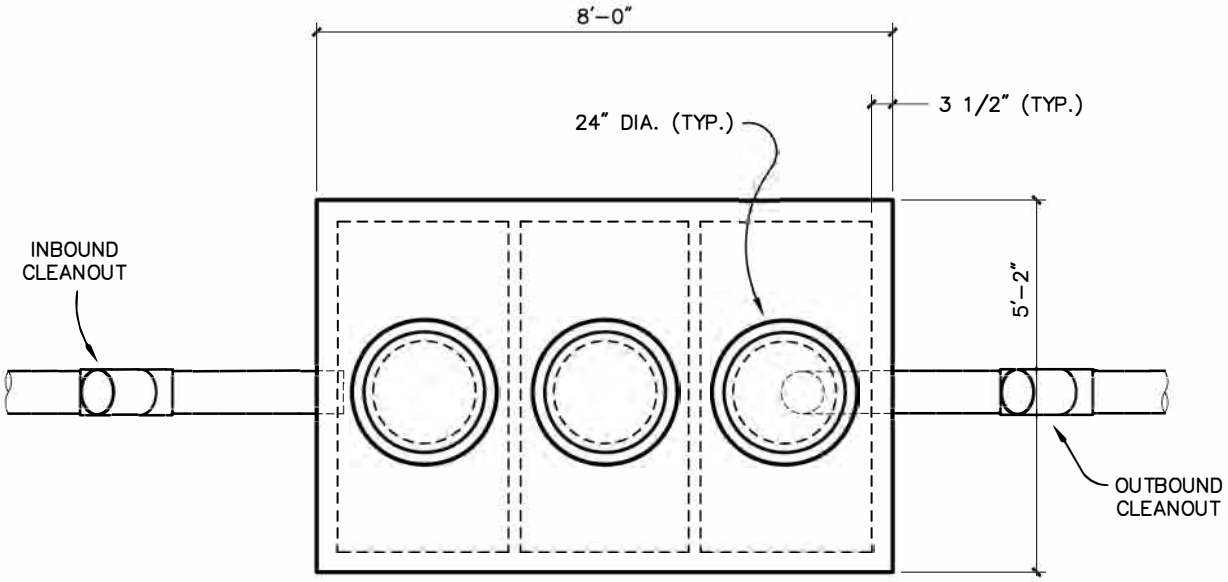
1. THE PIPE FOR THE INCLINED EXTENSION FOR CLEANOUT SHALL BE 8" DIA. IF SEWER IS LARGER THAN 8", THEN A REDUCER SHALL BE PLACED BETWEEN END OF SEWER AND LONG RADIUS BEND.
2. JOINTS SHALL BE SAME AS SPECIFIED FOR SEWER CONSTRUCTION.



LATERAL AND PROPERTY LINE RISER DETAILS

NOTE

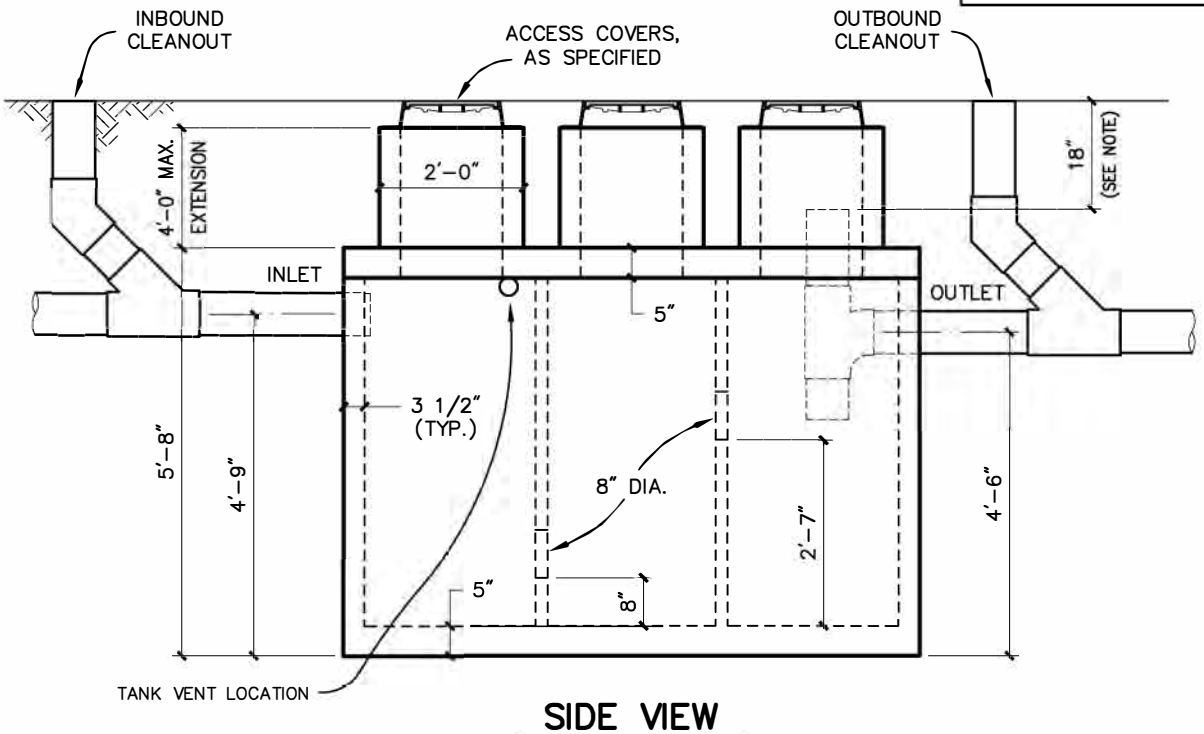
PROPERTY LINE RISER IS REQUIRED WHEN LATERAL IS IN WATER OR WHEN OTHERWISE SPECIFIED.



TOP VIEW

NOTE

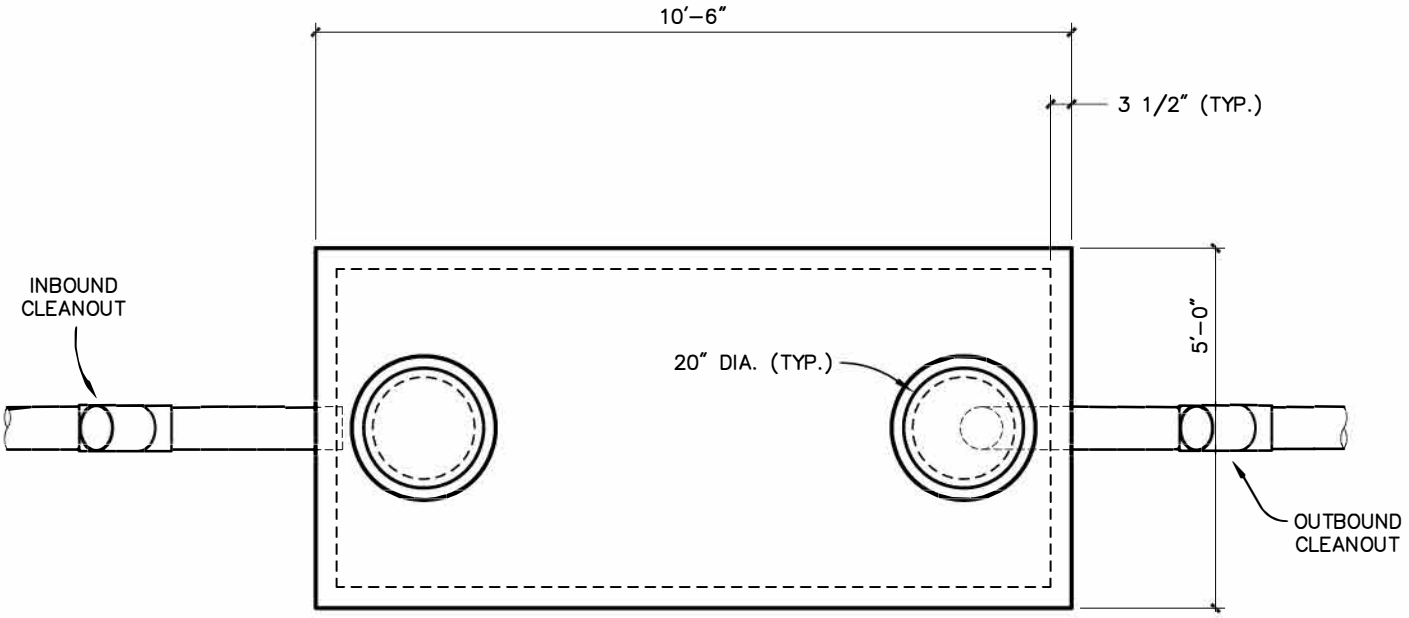
DROP LEG ASSEMBLY RISER MUST BE BROUGHT UP TO WITHIN 18" OF GRADE ELEVATION



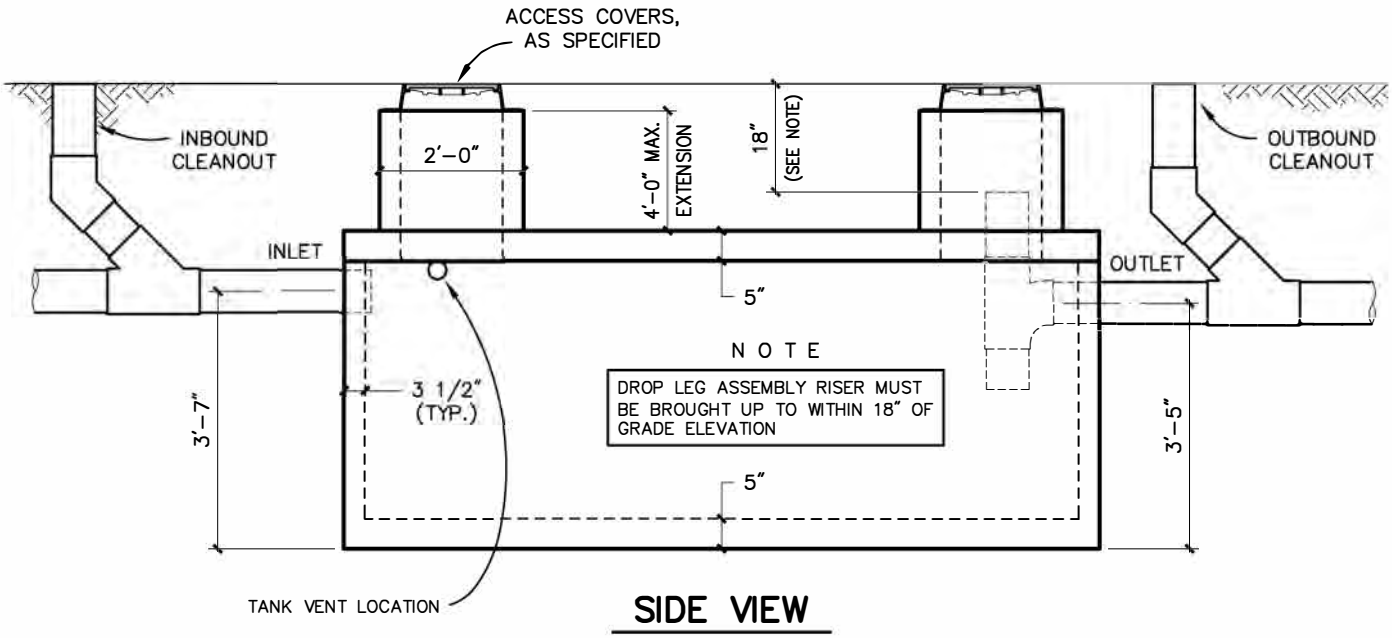
SIDE VIEW

- ACCESS COVERS MUST BE RATED FOR ANTICIPATED TRAFFIC LOAD.
- SEAL BETWEEN TANK AND EXTENSIONS MUST BE WATER TIGHT.
- THE TANK JOINT MUST BE GASKETED AND ENCAPSULATED WITH WRAPIDSEAL OR INFI-SHIELD.
- THE TANK MUST HAVE A VENT ABOVE ALL TANK INVERTS AND MUST BE MADE WATER TIGHT.
- INBOUND AND OUTBOUND PIPES MUST HAVE BOOTED SEAL AT TANK OPENING.
- 18" MINIMUM LENGTH ON OUTBOUND DROPLEG
- A SANITARY TEE MUST BE INCLUDED ON THE DROPLEG ASSEMBLY.

1,000 GALLON OUTDOOR GREASE INTERCEPTER



TOP VIEW



SIDE VIEW

- ACCESS COVERS MUST BE RATED FOR ANTICIPATED TRAFFIC LOAD.
- SEAL BETWEEN TANK AND EXTENSIONS MUST BE WATER TIGHT.
- THE TANK JOINT MUST BE GASKETED AND ENCAPSULATED WITH WRAPIDSEAL OR INFI–SHIELD.
- THE TANK MUST HAVE A VENT ABOVE ALL TANK INVERTS AND MUST BE MADE WATER TIGHT.
- INBOUND AND OUTBOUND PIPES MUST HAVE BOOTED SEAL AT TANK OPENING.
- 18″ MINIMUM LENGTH ON OUTBOUND DROPLEG
- A SANITARY TEE MUST BE INCLUDED ON THE DROPLEG ASSEMBLY.

1,000 GALLON OUTDOOR OIL & SAND SEPARATOR

(SHALLOW)

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SECTION 7

SPECIFICATIONS FOR FORCE MAINS

7.01 DESCRIPTION OF WORK

The work shall consist of furnishing and installing force main of the specified size or sizes at the depths shown on the drawings or specified herein, and furnishing all labor, materials, tools, and equipment for receiving, unloading, transporting, laying, and testing of force main pipe and fittings. Contractor shall furnish all necessary accessories to complete the pipe work as shown on the drawings and specified herein. Excavating, trenching and backfilling shall be as specified in Section 2.

The work shall be performed in accordance with the specifications and drawings, the MDOT 2020 Standard Specifications for Construction and the following specifications.

7.02 MATERIALS

All materials furnished by the Contractor shall conform to the specifications which follow. Where reference specifications are mentioned the current edition or latest issue shall be used.

7.02.01 Ductile Iron Pipe

7.02.01.01 Pipe

Ductile iron pipe shall conform to the requirements of AWWA C151 (ANSI A21.51). Ductile iron pipe shall be Class 53 unless otherwise specified.

7.02.01.02 Fittings

All fittings shall be ductile iron in accordance with AWWA C153 (ANSI A21.53). Fittings twenty-four (24) inches in diameter and smaller shall have a minimum pressure rating of 350 psi; fittings larger than twenty-four (24) inches in diameter shall have a minimum pressure rating of 250 psi.

7.02.01.03 Joints

Unless otherwise specified, all pipe joints shall be rubber gasket joints conforming to the requirements of AWWA C111 (ANSI A21.11) for bolted mechanical joints or push-on joints. Joints on fittings shall be bolted mechanical joints.

7.02.01.04 Cement Lining

All pipe and fittings shall have a cement mortar lining conforming to the requirements of AWWA C104 (ANSI A21.4). Epoxy lining may be used when approved by the Engineer.

7.02.02 Polyvinyl Chloride (PVC) Pipe

(When approved by Engineer or specified in project specifications.)

7.02.02.01 Pipe

Polyvinyl chloride (PVC) pipe, four inch through twelve inch (4" - 12") diameter, shall conform to ANSI/AWWA C900. The pipe shall have a pressure rating of 305 psi. The PVC pressure pipe shall have an outside diameter equivalent to cast iron and ductile iron pipe.

Polyvinyl chloride (PVC) pipe, fourteen inch through forty-eight inch (14" – 48") diameter shall conform to ANSI/AWWA C905. The pipe shall have a pressure rating of 305 psi. The PVC pressure pipe shall have an outside diameter equivalent to cast iron and ductile iron pipe.

Molecularly Oriented Polyvinyl Chloride (PVCO) pipe four inch through twenty-four inch (4" - 24") diameter shall conform to ANSI/AWWA C909. The pipe shall have a pressure rating of 305 psi. The PVCO pressure pipe shall have an outside diameter equivalent to cast iron and ductile iron pipe.

7.02.02.02 Fittings

Fittings shall be ductile iron as specified in Section 7.02.01.02.

7.02.02.03 Joints

Joints shall be bell and spigot with elastometric rubber gasket conforming to Section 4 of AWWA C900, C905, or C909, as applicable.

7.02.03 High Density Polyethylene (HDPE)

(When approved by Engineer or specified in project specifications.)

7.02.03.01 Materials

Pipe: Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350 with a minimum cell classification of PE345464C. Pipe O.D. sized 4" to 24" shall be available in both steel pipe sized (IPS) and ductile iron pipe sized (DIPS); unless otherwise specified or approved by the Engineer, iron pipe sized (IPS) shall be used. Pipe O.D. sized 26" to 54" shall be available in steel pipe

sized (IPS). Pipe shall have a manufacturing standard of ASTM D3035 and be manufactured by an ISO 9001 certified manufacturer. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

The pipe shall have a minimum working pressure rating of 160 psi.

7.02.03.02 Pipe Restraint

When thermal conditions can cause elongation or contraction of the pipe, the pipe shall have restraint collar(s) as shown in the locations and as detailed on the drawings. Restraint collars or restraining flanges may be required at locations where HDPE pipe connects to other pipe or when connecting to a manhole.

To limit the range of thermal expansion or contraction, HDPE force main shall be in place a minimum of 72 hours prior to any connections being made.

7.02.03.03 Fittings

A. BUTT FUSION FITTINGS: Butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification. All fittings shall be pressure rated to provide a working pressure rating no less than that of the pipe. The fitting shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

B. ELECTROFUSION FITTINGS: Electrofusion fittings shall be PE3408 HDPE, cell classification of 345464C as determined by ASTM D3350 and be the same base resin as the pipe.

Electrofusion fittings shall have a manufacturing standard of ASTM F1055.

C. FLANGED AND MECHANICAL JOINT ADAPTERS: Flanged and mechanical joint adapters shall be PE 3408 HDPE, cell classification of 345464C as determined by ASTM D3350 and be the same base resin as the pipe. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3261. All adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.

D. MECHANICAL RESTRAINT: Mechanical restraint for HDPE may be provided by mechanical means separate from the mechanical joint gasket sealing gland. The restrainer shall provide wide, supportive contact around the full circumference of the pipe and be equal to the listed widths. Means of restraint shall be machined serrations on the inside

surface of the restrainer equal to or greater than the listed serrations per inch and width. Loading of the restrainer shall be by a ductile iron follower that provides even circumferential loading over the entire restrainer. Design shall be such that restraint shall be increased with increases in line pressure.

Serrated restrainer shall be ductile iron ASTM A536 with a ductile iron follower; bolts and nuts shall be corrosive resistant, high strength alloy steel.

The restrainer shall have a pressure rating of, or equal to, that of the pipe on which it is used or 150 PSI whichever is lesser. Restrainers shall be JCM Industries, Sur-Grip or pre-approved equal.

Nominal Size	Restraint Width	Serrations per inch
4", 6"	1 ½"	8
8", 10" & 12"	1 ¾"	8

Pipe stiffeners shall be used in conjunction with restrainers. The pipe stiffeners shall be designed to support the interior wall of the HDPE. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed of 304 or 316 stainless steel to the HDPE manufacturers published average inside diameter of the specific size and DR of the HDPE. Stiffeners shall be by JCM Industries or pre-approved equal.

7.02.03.04 Joining

A. BUTT FUSION: Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 - 450 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself.

B. SIDEWALL FUSION: Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.

C. MECHANICAL: Bolted joining may be used where the butt fusion method cannot be used. Flange joining will be accomplished by using a HDPE flange adapter with a ductile iron back-up ring. Mechanical joint joining will be accomplished using either a molded mechanical joint adapter or the combination of a Sur-Grip Restrainer and Pipe Stiffener as manufactured by JCM Industries, Inc. Either mechanical joint joining method will have a ductile iron mechanical joint gland.

D. OTHER: Socket fusion, hot gas fusion, threading, solvents, and epoxies may not be used to join HDPE pipe.

7.02.04 Resilient Seated Gate Valves (4"-24")

Resilient seated gate valves shall be added at manifolds of forcemain or as shown on the drawings.

All valves shall conform to AWWA C509 or C515, Standards for Resilient-Seated Gate Valves for Water Supply Service. The valves shall be fully bronze mounted and shall be furnished with O-ring packing. The direction of the opening shall conform to the Owners standards.

Valves shall be EJ Iron Works FlowMaster, Clow Corporation R/W Resilient Wedge, Waterous Resilient Wedge, U.S. Pipe Metroseal 250 or equal.

7.02.05 Plastic Wrap for Pipe

Where indicated on the drawings or in the specifications, the pipe shall be encased in a seamless polyethylene tube, in accordance with AWWA C105 (ANSI A21.5) of eight (8) mills minimum thickness. The ends of adjacent sections of polyethylene tubing shall be overlapped a minimum of one (1) foot, and the joint taped or otherwise secured to prevent displacement during backfill operations.

7.03 HANDLING OF MATERIAL

Contractor shall use care and proper equipment while unloading and distributing force main materials on the job site to ensure the materials are not damaged.

Pipe and/or fittings shall not be rolled or skidded off the truck beds against previously unloaded materials.

7.04 ALIGNMENT AND GRADE

7.04.01 General

The force main shall be laid and maintained to the required lines and grades with fittings at the required locations. All force mains shall maintain a ten foot (10') horizontal separation and eighteen inch (18") vertical separation from water main.

7.04.02 Deviations Occasioned by Other Structures

Whenever obstructions not shown on the drawings are encountered during the progress of the work and interfere to such an extent that an alteration in the drawings is required, the Engineer shall have the authority to change the drawings and order a deviation from the line and grade or arrange with the owner of the structures for the removal, relocation, or reconstruction of the obstructions. If the change in drawings results in a change in the amount of work by the Contractor, such altered work shall be done by written change order only on the basis of payment to the Contractor for extra work or credit to the Owner for less work.

7.04.03 Depth of Pipe

All pipe shall be laid with the top of the pipe a minimum depth of five (5) feet below established street centerline grade, and with a minimum cover of five (5) feet below existing grade at the force main, unless specified otherwise.

7.05 LAYING

7.05.01 Lowering of Force Main Material Into Trench

Proper implements, tools, and facilities shall be provided and used by the Contractor for the safe and expedient completion of the work. All pipe and fittings shall be carefully lowered into the trench by means of suitable tools or equipment, in such a manner as to prevent damage to force main material and protective coatings and linings. Under no circumstances shall force main materials be dropped or dumped into the trench.

If damage occurs to any pipe or fittings in handling, the damage shall be immediately brought to the Engineer's attention. The Engineer shall prescribe corrective repairs or rejection of the damaged items.

7.05.02 Inspection Before Installation

All pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation in final position. Spigot ends shall be examined with particular care as this area is the most vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the Engineer, who will prescribe corrective repairs or rejection.

7.05.03 Cleaning of Pipe and Fittings

All lumps, blisters, and excess coating shall be removed from the bell and spigot ends of each pipe, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid.

7.05.04 Laying of Pipe

All dirt or other foreign material shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means during and after laying. No tools or other articles shall be stored in the pipe at any time.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. For force main construction, the spigot end shall be installed in the direction away from the pump station so as to minimize effluent material hanging up on the pipe joints. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space.

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

7.05.05 Cutting of Pipe

The Contractor shall cut the pipe in a straight and uniform manner, at right angles to the axis of the pipe, wherever necessary for placing valves, fittings, or closure pieces without damage to the pipe, and without extra cost to the Owner. The cut ends of the pipe shall be beveled before assembly of the joint.

The method of cutting pipe shall be subject to the approval of the Engineer.

7.05.06 Locator Wire

A 12 AWG insulated copper locator wire shall be attached to the force main pipe (regardless of material type) at approximately five (5) foot intervals using tape or other suitable methods to assure that the wire is not dislocated during pipe installation and backfilling. All joints shall be soldered and taped or suitably insulated.

The locator wire shall be brought to the surface at all cleanouts and attached to a cleanout plug bolt. At air release valve manholes, the locator wire shall be brought to the ground surface and attached to a post above grade.

Locator wire for Horizontal Directional Drilling (HDD) operations shall be 12 AWG (min.) high strength locator wire with a minimum break load of 1150 lbs. Protective insulating coating shall be High Molecular Weight, High Density Polyethylene (HWD-HDPE) 45 mil. (min.). Prior to acceptance of the force main the Contractor must verify the continuity of the tracer wire in the presence of the Owner or Engineer and repair any breaks in the line.

7.06 JOINING OF MECHANICAL - JOINT PIPE

7.06.01 General Requirements

The general requirement in Sec. 7.04 - 7.05 inclusive shall apply except that, where the terms "bell" and "spigot" are there used, they shall be considered to refer to the bell and spigot ends of the lengths of mechanical-joint pipe.

7.06.02 Cleaning and Assembly of Joint

The last eight inches (8") outside of the spigot and inside of the bell of mechanical joint pipe shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter from the joint and then coated with a lubricant as supplied or recommended by the pipe manufacturer and approved by the Engineer. The retaining gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket, or bell, end. The rubber gasket shall be coated with lubricant and placed on the spigot end with the thick edge toward the gland.

7.06.03 Bolting of Joint

The entire section of the pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell; care shall be taken to locate the gasket evenly around the entire joint. The retaining gland shall be moved along the pipe into position for bolting, all of the bolts inserted, and the nuts screwed up tightly with the fingers. All nuts shall be tightened with a suitable (preferably torque-limiting) wrench. The torque for various sizes of bolts shall conform to ANSI/AWWA C600, Standard for Installation of Ductile-Iron Mains and Their Appurtenances as follows:

Size Inches	Range of Torque Foot – Pounds
5/8	45 – 60
3/4	75 - 90
1	100 - 120
1-1/4	120 – 150

Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland. When tightening bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. This may be done by partially tightening the bottom bolt first, then the top bolt, next the bolts at either side, and last, the remaining bolts. Repeat this cycle until all bolts are within the above range of torques. If effective sealing is not attained at the maximum torque indicated above, the joint should be disassembled and reassembled after thorough cleaning. Over stressing of bolts to compensate for poor installation practice is not allowed. Unless

otherwise specified, Mega-lugs as manufactured by EBAA Iron Sales, Inc. or approved equal shall be used for restraining gland.

7.06.04 Permissible Deflection in Mechanical-Joint Pipe

Whenever it is desirable to deflect mechanical-joint pipe in order to form a long radius curve, the amount of deflection shall not exceed the maximum limits shown in Table 1.

TABLE 1
PERMISSIBLE DEFLECTIONS IN MECHANICAL - JOINT PIPE

Size of Pipe Inches	Max. Permissible Deflection Per Length - Inches		Approx. Radius of Curve Produced By Succession of Joints - Feet	
	18'	20'	18'	20'
3	31	35	125	140
4	31	35	125	140
6	27	30	145	160
8	20	22	195	220
10	20	22	195	220
12	20	22	195	220
14	13.5	15	285	320
16	13.5	15	285	320
18	11	12	340	380
20	11	12	340	380
24	9	10	450	500

7.07 JOINING OF PUSH-ON JOINT PIPE

7.07.01 General Requirements

The general requirements in Section 7.04 - 7.05 inclusive shall apply except that, where the terms "bell" and "spigot" are there used, they shall be considered to refer to the bell and spigot ends of the lengths of push-on joint pipe.

7.07.02 Cleaning and Assembly of Joint

The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell socket.

A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot end of the pipe or both. Gasket lubricant shall be as supplied or recommended by the pipe manufacturer and approved by the Engineer.
The spigot end of the pipe shall be centered in the bell and forced or pushed home. Smaller sizes of pipe can be pushed or forced into place by hand; larger sizes will require the use of mechanical assistance.

7.07.03 Permissible Deflection in Push-On Joint Pipe

Whenever it is desirable to deflect push-on joint pipe, in order to form a long radius curve, the amount of deflection shall not exceed the maximum limits shown in Table 2, unless recommended by the pipe manufacturer and approved by the Engineer.

TABLE 2

PERMISSIBLE DEFLECTIONS IN PUSH-ON JOINT PIPE

Size of Pipe Inches	Max. Permissible Deflection Per Length - Inches		Approx. Radius of Curve Produced By Succession of Joints - Feet	
	18'	20'	18'	20'
3	19	21	205	230
4	19	21	205	230
6	19	21	205	230
8	19	21	205	230
10	19	21	205	230
12	19	21	205	230
14	11	12	340	380
16	11	12	340	380
18	11	12	340	380
20	11	12	340	380
24	11	12	340	380
30	11	12	340	380
36	11	12	340	380
42	11	12	340	380
48	-	12	-	380

7.08 ANCHORAGE

7.08.01 Anchorage for Plugs, Caps, Tees, and Bends

Unless otherwise specified or approved by the Engineer, movement of all plugs, caps, tees, and bends shall be prevented by use of restrained joint pipe or joint restraining glands. Joint Restraining glands shall not be used to provide restraint to plain end fittings

7.08.01.01 Restrained Joint Pipe

The use of restrained joint pipe first shall be approved by the Owner. If approved, all ductile iron restrained joint pipe shall be Clow Corporation "Super-Lock"; American Ductile Iron Pipe "Lok-Ring Joint" or "Flex-Ring Joint"; or approved equal. All components of the restrained joint shall be as manufactured, supplied, or recommended by the manufacturer of the restrained joint pipe system actually installed.

7.08.01.02 Joint Restraining Glands

Joint restraining glands shall be Megalug as manufactured by EBAA Iron Sales, Inc. or approved equal. Joint restraining glands shall not be used to provide restraint to plain end fittings.

When joints are to be restrained with mechanical devices as noted above, all joints shall be restrained for a minimum distance from the fitting as required in the following table:

PIPE RESTRAINT LENGTH REQUIRED, FEET*

Pipe Diameter	Tees, 90º Bends	45º Bends	22-1/2º Bends	11-1/4º Bends	Dead Ends	Reducers (one size)	**
4"	23	9	5	2	57		
6"	32	13	6	3	82	43	63
8"	41	17	8	4	104	43	55
12"	58	24	12	6	149	80	120
16"	74	31	15	7	192	82	110
20"	89	37	18	9	233	82	104
24"	104	43	21	10	272	82	99
30"	123	51	25	12	328	115	148
36"	141	58	28	14	379	115	140

***A multiplier of 1.43 shall be used if the pipe is installed with polyethylene wrap.**

**If the straight run of pipe on the small side of the reducer exceeds this value, then no restrained joints are necessary.

NOTE: The length of restrained joint pipe required as shown in the table above is based on trench backfill being compacted to ninety five (95%) percent of maximum unit weight in accordance with MDOT procedures. If the pipe is wrapped in polyethylene, a greater length of restrained pipe will be required as specified or shown on the drawings.

All joints lying within the above minimum distances from the fitting must be restrained as noted herein.

Tees: Tees shall be restrained in the branch direction as required in the table above. Also, to augment the above, in the straight through direction, the minimum length of the first pipe on either side of the tee shall be ten (10) feet.

Bends: Bends shall be restrained in both directions as required in the table above.

7.08.02 Reaction Backing (Thrust Blocks)

Reaction backing (thrust blocks) shall be used only at locations indicated on the drawings, or approved by the Engineer.

Reaction backing shall be concrete having a compressive strength of not less than 2,000 psi after twenty-eight (28) days. Backing shall be placed between solid, undisturbed ground and the fitting to be anchored. The area of bearing on the pipe and on the ground in each instance shall be that shown in the table below or directed by the Engineer. The backing shall, unless otherwise shown or directed, be so placed that the pipe and fitting joints will be accessible for repair.

REACTION BACKING

Minimum Bearing Area against undisturbed trench wall, in square feet, for sand is indicated in the table below. Details of placement are shown in Standard Details.

Pipe Size	Tees, Plugs, Wyes, 45º Els	90º Els	Wyes, 22-1/2º Els or Less
6"	3	3	1
8"	4	6	2
10"	7	9	3
12"	9	11	3
16"	13	20	6
20"	20	28	8
24"	28	40	11

Other Soil Conditions

Cement Sand or Hardpan	-	multiply above by 0.5
Gravel	-	multiply above by 0.7
Hard Dry Clay	-	multiply above by 0.7
Soft Clay	-	multiply above by 2.0

Muck – secure all fittings with restrained joint pipe or joint restraining glands, with concrete reaction backing the same as listed for sand conditions.

7.09 CLEAN OUTS

Single and double clean outs shall be constructed as shown on the standard detail. All pipe and fittings for the clean out shall be ductile iron, unless otherwise specified.

Unless otherwise specified, manhole castings shall be EJ No. 1040 with Type A solid cover or approved equal.

7.10 AIR RELEASE VALVES

7.10.01 Air Release Valve

Air release valve shall be APCO 400WA sewage valve, Crispin S20SB, Val-Matic VM-48ABW, ARI-D025, or approved equal, with inlet and orifice size as specified. Riser and fittings to be brass, valves to be ¼ turn brass ball valves. Location of air release valve shall be shown on the construction drawings.

7.10.02 Air Release Valve Manhole

Air release valve manholes shall be constructed in accordance with the Standard Details and as specified herein.

Precast bases shall be installed on the subbase in such a way as to provide a uniform bearing under the manhole base.

Precast manholes with integral bottom may be used; however, any changes to the structure due to minor field adjustments in alignment and grade required to meet construction conditions, shall be made by the Contractor at no additional cost to the Owner.

7.10.03 Flexible Manhole Connectors (Rubber Boots)

Flexible manhole connectors (also called rubber boots) shall be "Kor-N-Seal" by National Pollution Control Systems, Inc., "P.S.X." or "Press Wedge II" by Press Seal Gasket Corporation, "Lock Joint Flexible Manhole Sleeve" by Inter Pace Corporation, “A-LOK,” “Z-LOK,” or “QUIK-LOK” by A-LOK Products, Inc. or approved equal. Flexible manhole connectors shall conform to the requirements of ASTM Designation C923, Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

7.11 HYDROSTATIC TESTS

7.11.01 Procedure

All tests will be made by the Contractor using his own equipment, operators, and supervision, in the presence of the Engineer or his duly authorized representative. The length of the section to be tested shall be as approved by the Engineer, or as shown on the drawings.

7.11.02 Air Removal Before Test

Before applying the specified test pressure, all air shall be expelled from the pipe.

If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so the air can be expelled as the line is filled with potable water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure of 150 psi applied.

7.11.03 Leakage Test

A leakage test shall be conducted during the hydrostatic pressure test in the presence of the Engineer. The Contractor shall furnish the pump, pipe, connections, gages, and all other necessary apparatus, and shall furnish the necessary assistance to conduct the test. The duration of the leakage test shall be a minimum of two (2) hours and during the test the main shall be subjected to a pressure of 150 psi. When several valved sections are tested as one test, the maximum allowable leakage will be equivalent to the calculated allowable leakage for the smallest valved section therein.

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified leakage test pressure after the air in the pipeline has been expelled, and the pipe has been filled with water. No pipe installation will be accepted if the leakage is greater than that determined by the formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

Where:

L = Allowable leakage in gallons per hour

S = Length of pipe tested, in feet

D = Nominal diameter of the pipe, in inches

P = Average test pressure during the leakage test, in pounds per square inch gage.

This formula is based on allowable leakage of 10.49 gallons per day, per mile of pipe, per inch of nominal diameter at 150 psi.

The Owner shall be furnished a written report of the results of the leakage test that identifies the specific length of pipe tested, the pressure, the duration of the test, and the amount of leakage. The report shall be signed by the Contractor and the Engineer.

7.11.04 Hydrostatic Test – HDPE Pipe

The hydrostatic test procedure shall conform to ASTM F2164. Testing in the trench, fill the pipeline with water and bleed off any trapped air. Subject the lowest element in the system to a test pressure that is 1.5 times the design pressure or a minimum of 100 psi, whichever is greater, and check for any leakage. When, in the opinion of the Engineer, local conditions require that the trenches be backfilled immediately after the pipe has been laid, apply the pressure test after backfilling has been completed but not sooner than a time which will allow sufficient curing of any concrete that may have been used. Typical minimum concrete curing times are two (2) days for early strengths and seven (7) days for normal strengths.

The test procedures consist of two steps; the initial expansion and the test phase. When test pressure is applied to a water-filled pipe, the pipe expands. During the initial expansion of the pipe under test, sufficient make-up water must be added to the system as needed for up to four (4) hours to maintain the test pressure. After four (4) hours, initial expansion should be complete and the actual test can start.

After four (4) hours of maintaining pressure as described above, the pressure shall then be dropped by 10 psi. At this point do not increase pressure or add make-up water. If the pressure then remains within five (5%) percent of the target value for one (1) hour, this indicates there is no leakage in the system.

Note: Under no circumstances shall the total time under test exceed eight (8) hours at 1 ½ times the system pressure rating. If the test is not complete within this time limit (due to leakage, equipment failure, etc.), the test section shall be permitted to "relax" for eight (8) hours prior to the next test sequence.

7.11.05 Variation from Permissible Leakage

If any test of pipe laid discloses leakage greater than that specified above, the Contractor shall at his own expense locate and repair the leaks until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of the allowance used for testing.

7.11.06 Time for Making Test

The pipe may be subject to hydrostatic pressure and inspected and tested for leakage at any convenient time after the trench has been partially backfilled. Where any section of the main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least seven (7) days have lapsed after the concrete reaction backing was installed. If high-early-strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two (2) days have elapsed.

7.12 MEASUREMENT AND PAYMENT

7.12.01 General

All proposed construction shall be measured for payment by the Engineer in accordance with the items listed in the proposal.

The unit price bid for each Proposal item shall be payment in full for completing the work, ready for use as specified.

7.12.02 Force Main

Measurement of the length of the force main shall be in lineal feet along the centerline of the force main.

7.12.03 Fittings

When a specific item is provided in the Proposal for Bends, Tees, or Wyes, the unit price bid shall be the additional cost of furnishing and placing the Bend, Tee or Wye over and above the cost of furnishing and laying the force main.

When no proposal item is provided, the work shall be incidental to the major items of work.

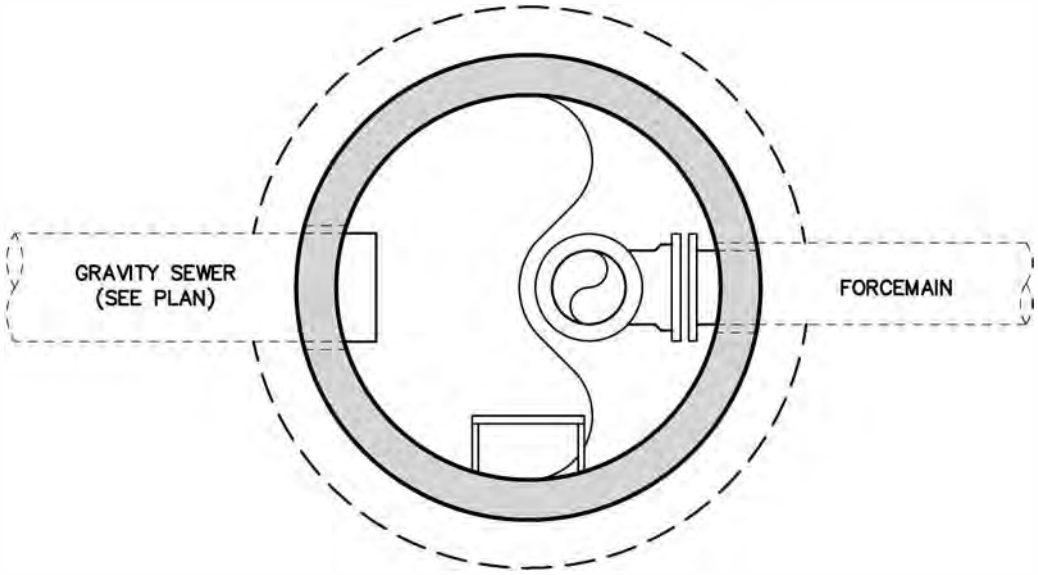
7.12.04 Clean-Outs

When a specific item is provided in the proposal for Single or Double Clean-Out, the unit price bid shall be the additional cost of furnishing and placing the required fittings, plug and pipe over and above the cost of furnishing and laying the force main.

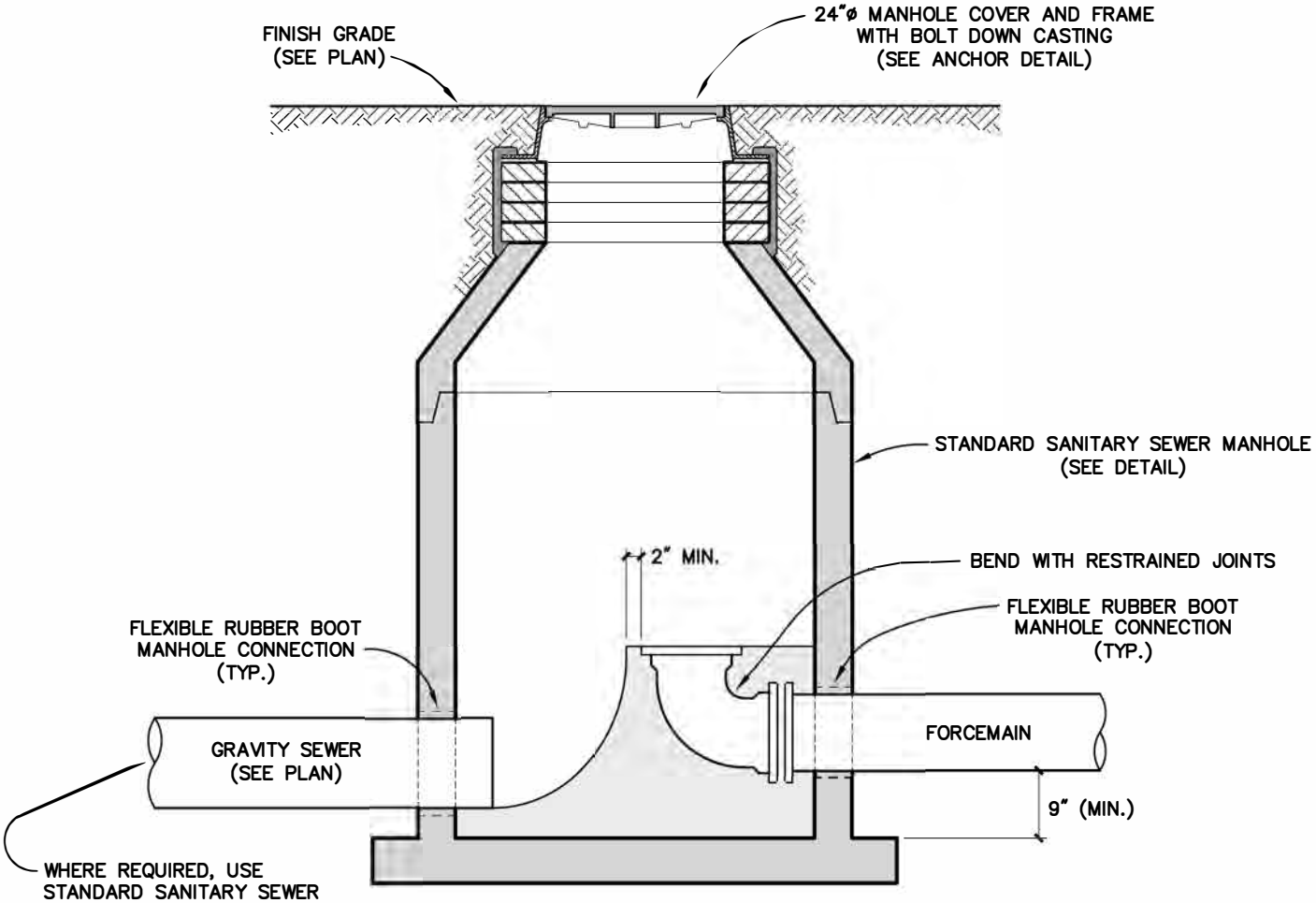
When no proposal item is provided, the work shall be incidental to the major items of work.

7.12.05 Air Release Valves

Air release valves shall be paid for in accordance with the units established in the proposal and shall include the furnishing and installing the precast manhole in accordance with the standard detail.



PLAN VIEW



SECTIONAL VIEW

STANDARD FORCE MAIN DISCHARGE MANHOLE

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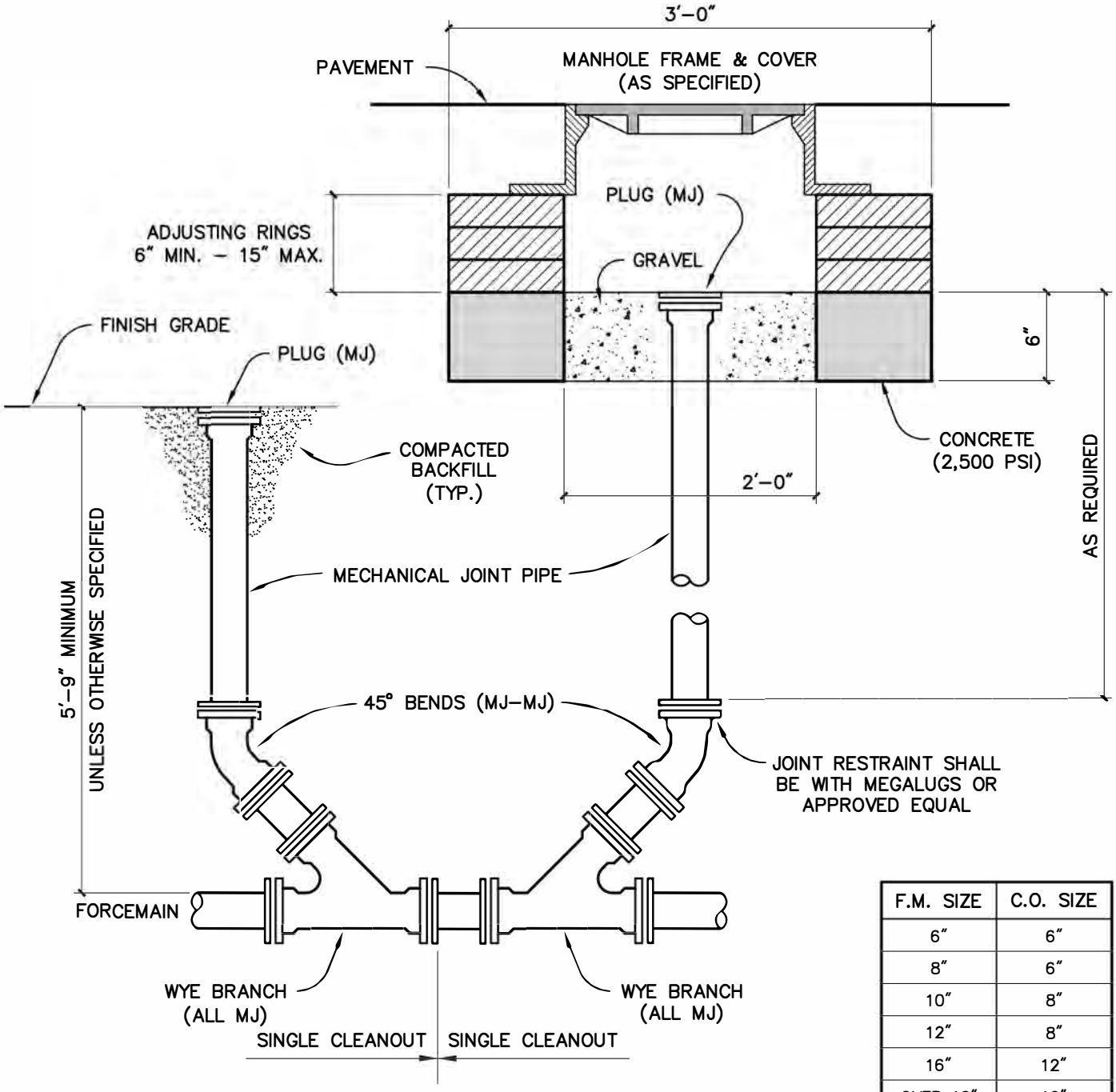


F.M. SIZE	C.O. SIZE
6"	6"
8"	6"
10"	8"
12"	8"
16"	12"
OVER 16"	12"

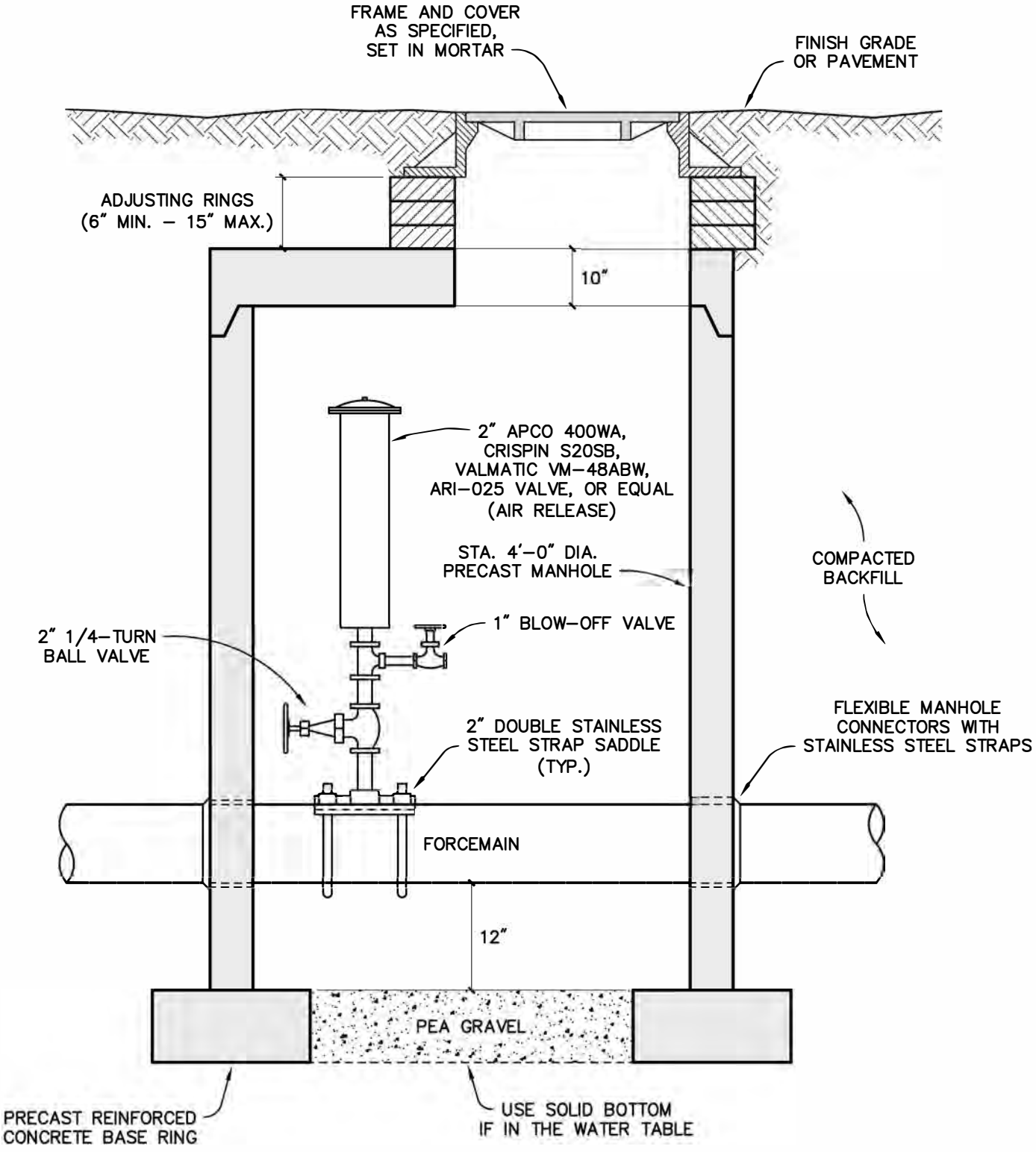
STANDARD DOUBLE CLEAN OUT

(FORCEMAIN)

NOTE

1. ALL MATERIALS IN CLEAN OUT ASSEMBLY SHALL BE DUCTILE IRON UNLESS OTHERWISE NOTED.
2. ALL CLEANOUTS SHALL HAVE MANHOLE FRAME AND COVER UNLESS OTHERWISE SPECIFIED.

Prein&Newhof
11/2021
Section 7 Forcemain



STANDARD AIR RELEASE VALVE – MANHOLE

NOTE

1. PRECAST CONCRETE MANHOLE SHALL MEET ASTM C478.
2. INSTALL AIR RELEASE VALVE AT THE VERY HIGHEST ELEVATION OF THE FORCEMAIN.

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Appendix C

U.S.F.W.S. CORRESPONDENCE

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Michigan Ecological Services Field Office
2651 Coolidge Road Suite 101
East Lansing, MI 48823-6360
Phone: (517) 351-2555 Fax: (517) 351-1443
http://www.fws.gov/midwest/endangered/section7/s7process/step1.html

In Reply Refer To: December 01, 2020
Consultation Code: 03E16000-2021-SLI-0274
Event Code: 03E16000-2021-E-00914
Project Name: City of Hart Wastewater Improvements

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The attached species list identifies any federally threatened, endangered, proposed and candidate species that may occur within the boundary of your proposed project or may be affected by your proposed project. The list also includes designated critical habitat if present within your proposed project area or affected by your project. This list is provided to you as the initial step of the consultation process required under section 7(c) of the Endangered Species Act, also referred to as Section 7 Consultation.

Section 7 of the Endangered Species Act of 1973 requires that actions authorized, funded, or carried out by Federal agencies not jeopardize federally threatened or endangered species or adversely modify designated critical habitat. To fulfill this mandate, Federal agencies (or their designated non-federal representative) must consult with the Fish and Wildlife Service if they determine their project may affect listed species or critical habitat.

There are several important steps in evaluating the effects of a project on listed species. Please use the species list provided and visit the U.S. Fish and Wildlife Service's Region 3 Section 7 Technical Assistance website at http://www.fws.gov/midwest/endangered/section7/s7process/index.html. This website contains step-by-step instructions to help you determine if your project may affect listed species and lead you through the section 7 consultation process.

Under 50 CFR 402.12(e) (the regulations that implement section 7 of the Endangered Species Act), the accuracy of this species list should be verified after 90 days. You may verify the list by visiting the ECOS-IPaC website (http://ecos.fws.gov/ipac/) at regular intervals during project planning and implementation and completing the same process you used to receive the attached list.

For all **wind energy projects** and **projects that include installing towers that use guy wires or are over 200 feet in height**, please contact this field office directly for assistance, even if no federally listed plants, animals or critical habitat are present within your proposed project area or may be affected by your proposed project.

Please see the "Migratory Birds" section below for important information regarding incorporating migratory birds into your project planning. Our Migratory Bird Program has developed recommendations, best practices, and other tools to help project proponents voluntarily reduce impacts to birds and their habitats. The Bald and Golden Eagle Protection Act prohibitions include the take and disturbance of eagles. If your project is near an eagle nest or winter roost area, see our Eagle Permits website at https://www.fws.gov/midwest/eagle/permits/index.html to help you avoid impacting eagles or determine if a permit may be necessary.

Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/administrative-orders/executive-orders.php.

We appreciate your concern for threatened and endangered species. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Michigan Ecological Services Field Office
2651 Coolidge Road Suite 101
East Lansing, MI 48823-6360
(517) 351-2555

Project Summary

Consultation Code: 03E16000-2021-SLI-0274

Event Code: 03E16000-2021-E-00914

Project Name: City of Hart Wastewater Improvements

Project Type: WASTEWATER PIPELINE

Project Description: Replacement of sanitary sewer & forcemain. Improvements to wastewater treatment facility.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/43.686099449805226N86.32453986017381W

Counties: Oceana, MI

Endangered Species Act Species

There is a total of 8 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5949 General project design guidelines: https://ecos.fws.gov/ipac/guideline/design/population/1/office/31410.pdf	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045 General project design guidelines: https://ecos.fws.gov/ipac/guideline/design/population/10043/office/31410.pdf	Threatened

Birds

NAME	STATUS
Piping Plover *Charadrius melodus* Population: [Great Lakes watershed DPS] - Great Lakes, watershed in States of IL, IN, MI, MN, NY, OH, PA, and WI and Canada (Ont.) There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Endangered
Red Knot *Calidris canutus rufa* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Only actions that occur along coastal areas during the Red Knot migratory window of MAY 1 - SEPTEMBER 30. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *Grus americana* Population: U.S.A. (AL, AR, CO, FL, GA, ID, IL, IN, IA, KY, LA, MI, MN, MS, MO, NC, NM, OH, SC, TN, UT, VA, WI, WV, western half of WY) No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/758	Experimental Population, Non-Essential

Reptiles

NAME	STATUS
Eastern Massasauga (=rattlesnake) *Sistrurus catenatus* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ All Projects: Project is Within EMR Range Species profile: https://ecos.fws.gov/ecp/species/2202 General project design guidelines: https://ecos.fws.gov/ipac/guideline/design/population/7800/office/31410.pdf	Threatened

Insects

NAME	STATUS
Karner Blue Butterfly *Lycaeides melissa samuelis* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/6656	Endangered

Flowering Plants

NAME	STATUS
Pitcher's Thistle *Cirsium pitcheri* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8153	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American Golden-plover *Pluvialis dominica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31

NAME	BREEDING SEASON
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Semipalmated Sandpiper *Calidris pusilla* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ “Proper Interpretation and Use of Your Migratory Bird Report” before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

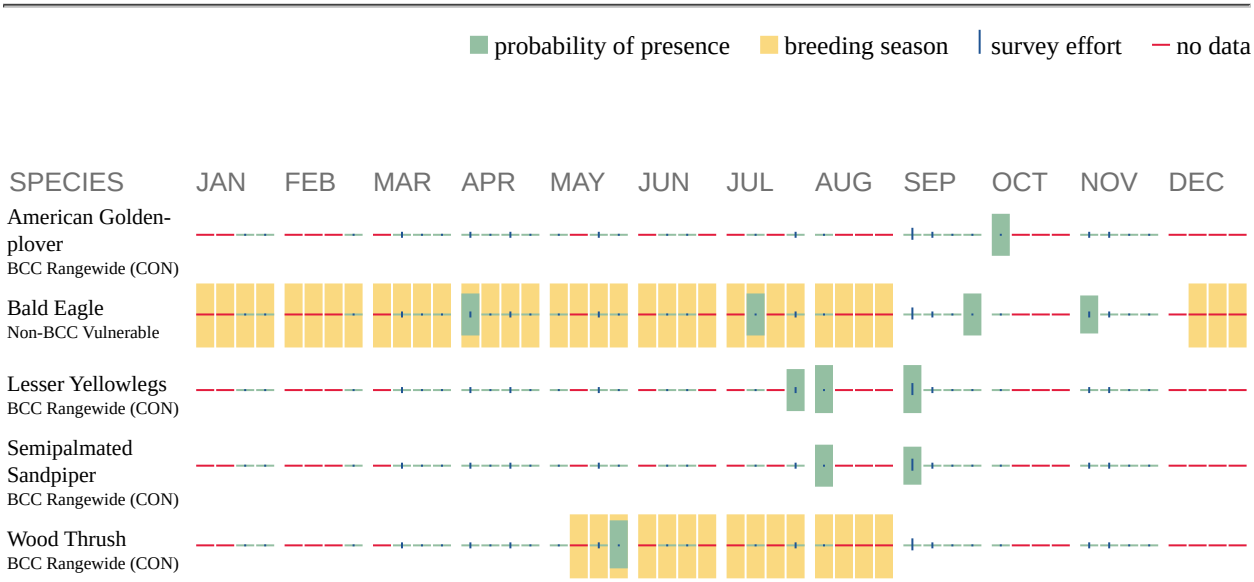
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php

- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.
Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?
The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and

how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ “What does IPaC use to generate the migratory birds potentially occurring in my specified location”. Please be aware this report provides the “probability of presence” of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the “no data” indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ “Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds” at the bottom of your migratory bird trust resources page.

Wetlands

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER EMERGENT WETLAND

- PEM1A

FRESHWATER FORESTED/SHRUB WETLAND

- PFO1A
- PSS1C

FRESHWATER POND

- PUBK

RIVERINE

- R4SBC